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Illumination Played No Small Part in the Celebration of Armistice Night in Washington, D. C.

Special Features of Festival of Light at Washington

Elaborate Preparations for Illumination in Connection With Celebration of Armistice Day Result in Wonderful Display—Searchlights and Novagem Jewels Used with Other Equipment

By C. D. WAGONER

The Festival of Light, the transformation of Washington into a Luminous Night City, was the talk and marvel of the thousands who visited the national capitol on armistice day to pay homage to the Unknown Soldier. Although, as a whole, the Panama-Pacific exposition stands without equal for its illumination, the Jeweled Portal in Washington, as a unit, is the greatest conception of decorative lighting the world has ever seen. In the curtain, which is 87 ft. wide, and the two obelisks supporting it are 37,000 Novagem jewels. Of these 32,000 are of pure crystal and jonquil, and 5000 are of ruby, aquamarine, amethyst, topaz and emerald. In a great central sunburst upon this tapestry are the flags and coat-of-arms of the eight visiting nations participating in the Limitation of Arms Conference—Great Britain, France, Japan, Italy, China, Belgium, Netherlands and Portugal.

For the Avenue of Light leading to the Jeweled Portal rows of 4-burner Roman lamps with flaring torch-like flames gave the soft tone desired to carry out the entire effect of Ryan's Luminous Night. In front of the Pan American, D. A. R. and Red Cross buildings and Continental Hall 16 heraldic banner standards similar to those which

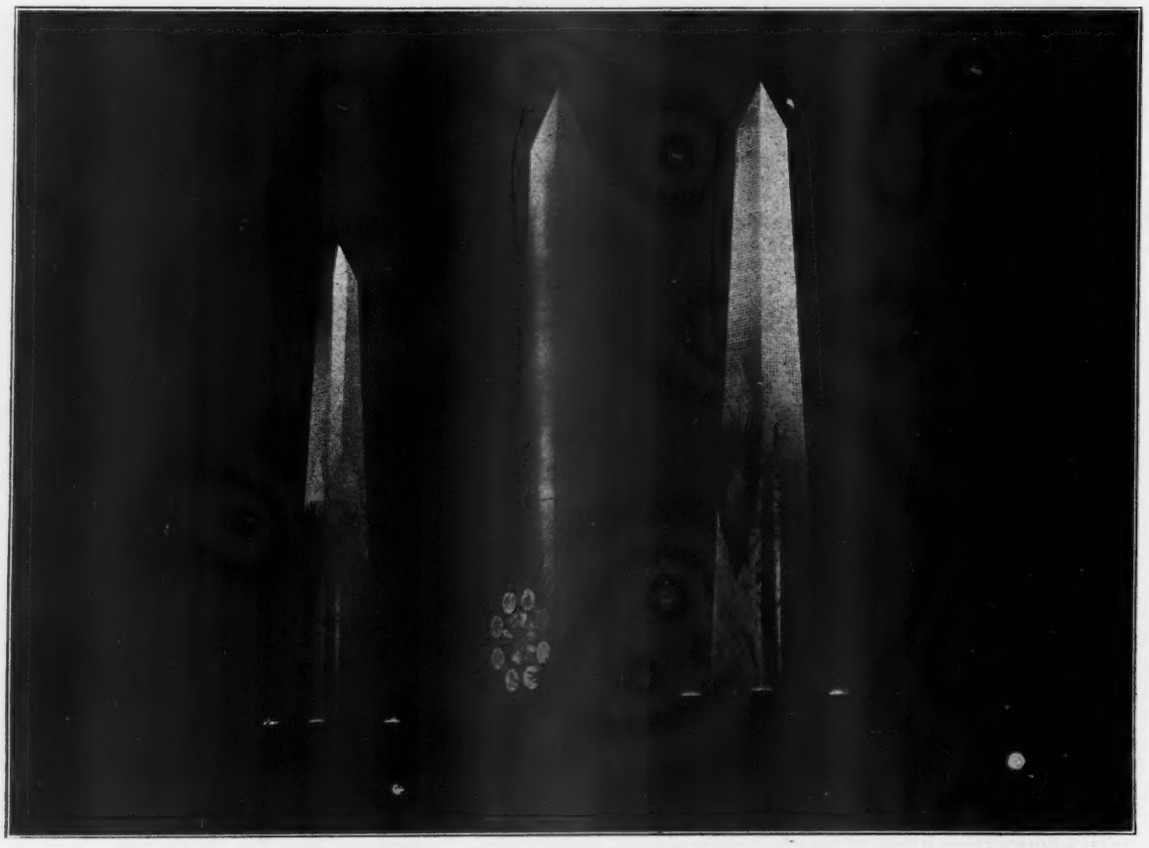
were erected in the south gardens of the Panama exposition gave the avenue somewhat of a carnival keynote. Concealing the lights on three sides and emitting just the subdued tones toward the street these banners acted as reflectors in casting the mellow rays of light onto the structures. Rose-colored lights beneath the shrubbery added to the atmosphere.

The Washington monument but a few hundred feet away was literally washed in light. Rays from four batteries of powerful searchlights, reflected in mirrors, were cast up each side of the lofty shaft. As the opening salute of 21 guns was fired these lights, with various colored screens, picked up the clouds of smoke and followed them until they disappeared, giving a most spectacular effect. From the top of the monument more searchlights sent out their rays, as a lighthouse of the sea, illuminating the dome of the Capitol, the U. S. Naval Observatory, the White House, Lincoln Memorial, the amphitheater at Arlington, the Soldiers' Home and other buildings.

While the myriad of lights along 17th street fairly hynotized the crowds, in the distance with the dome of the Capitol as its center flashed the Light of the States. First, the colors of the rainbow, starting from a double shaft of red in the center and spreading out in the colors of the spectrum on either side; next, the national colors; then, all white; then, all rose colored, and then rose and white, the colors of the northern lights or aurora borealis. Equivalent to the combined light of nearly 2,000,000 candles, these rays extended upward over the city to such a height they were visible for miles around. The total light for the entire display was equivalent to that from 4,950,000,000 candles.

This Festival of Light was the inspiration of an expert, famed the country over as one of the greatest illumination engineers in the world—W. D'Arcy Ryan. For more than 25 yrs. he has devoted his entire time and study to this art. He has made hundreds of tests of light and color, the effects of different lights on pictures, on various colored silks and cloths and on art objects. He has invented instruments for measuring light projection and refraction which have raised illuminating engineering, the last specialized branch of electrical engineering, to an exact science. With his qualities of poet, painter and dramatist, coupled with his technical skill, he has directed the development of illumination as an art.

The most notable achievement of Mr. Ryan was his illumination of the Panama exposition in 1915. It was here that he introduced his Novagem jewels, used in Washington so extensively in the Portal of Jewels, at the threshold of the Pan American building. The idea was entirely new—his own creation. He searched Europe for the purest of glass and studied how to modify the cut so as not to lose the form yet gain the highest refractive power. He found what he wanted in Austria and imported them to this country. Since their use in the Tower of Jewels at the exposition they have been used but three times in the intervening 7 yrs. for decorative purposes—in the Victory Arches in Chicago and New York, and in an arch at Saratoga Springs celebrating the opening of a new street lighting system. Conse-



Jeweled Arch, With Washington Monument in Background, Forming Part of Armistice Night Spectacle in Washington, D. C., Designed by W. D'Arcy Ryan.

President Warren G. Harding Turning on the Lights for the Armistice Night Celebration in Washington, D. C.

quently, their use in Washington was a new feature to the majority.

Among other important illumination achievements of Mr. Ryan has been the lighting of the locks of the Panama Canal, the London underground railroad, the Maharajah Isu's palace in India, the Czar's palace at St. Petersburg, Niagara Falls, the Hudson Fulton celebration, and the cities of San Francisco, Los Angeles, Salt Lake and Saratoga, which today rank among America's best lighted municipalities. He has just signed a contract to design and direct the illumination at the Brazilian International exposition next fall, at an expense of more than $1,500,000. In fact, no lighting undertaking of any importance in the country has been attempted without the consultation or direction of Mr. Ryan. He is today, and has been for the past quarter of a century, director of the big illuminating laboratories of the General Electric Co.

That Mr. Ryan has turned illumination into a science as well as an art is evidenced from the display in Washington. Work was not started until 10 days before the night the lights were to be used. This meant there was no time for speculation, for testing out what would look best and fulfill desires. He knew before he started exactly what must be done. There were no changes from original plans—none were necessary. Guided by his power of design and visualization, he accomplished the work which has proven the marvel of Washington. That he has raised the illumination to a fine art has been proven in his emotions, sensed alike by the initiated and the uninitiated who during the three nights of the display stood fairly enthralled in the glowing, poetic land of color and light.

The Portal and Roman lamps were designed under Mr. Ryan's direction by J. W. Gosling, decorative engineer of the General Electric Co., who is now on his way to Brazil to make a preliminary survey of the exposition there. The construction work was under the direction of J. W. Shaffer, another engineer on Mr. Ryan's staff. The banners symbolizing peace, law and order were prepared by Charles E. Moberly, murial decorator at the capitol. The obelisks were built by Richard J. Beall and the jeweled necklace suspended between them by the W. G. Copeland Co. of Washington.

HIGHWAY LIGHTING ESSENTIAL TO MODERN TRAFFIC CONDITIONS.

Properly Designed Lighting Units Eliminate Glare and Light-and-Dark Spots on the Road—Equipment Ready for Use.

By H. H. ASHINGER,

George Cutter Works of Westinghouse Electric & Manufacturing Co., South Bend, Ind.

The enormous increase in the use of highways for long-distance travel in trucks and automobiles, and the ever increasing number of accidents at night, bring out the importance of proper lighting of roads by some means other than headlights of the vehicles themselves. Considerable attention has been devoted to the control of glare from automobile headlights by means of specially designed lenses and shields, but it is believed that desired results can be obtained only by means of independent lighting units mounted along the roadway. The proper lighting of highways is accomplished by fulfilling at least two equally important conditions:

(1) Providing a clear view of the whole roadway for a considerable distance ahead of the car, and (2) elimination of glaring lights within the range of vision of the drive. These are the two chief essentials to safe travel.

At the present high speed of travel on hard surface roads a well-lighted roadway far in advance of the car is essential in order that the driver may be able to discern obstacles of any nature in time to avoid accident. Sufficient light on either side is also desirable for lighting marking signs, fences, ditches and other objects in the direct path of the car. The importance of the first condition has lead to the extensive use of high-power headlights and adjustable search lights. These devices are absolutely essential until a more satisfactory system of lighting the road is provided. As a matter of fact, they would accomplish the desired results if all traffic were moving in one direction. However, as this is

seldom if ever the case their use entirely defeats the second condition.

Any bare light source directly within the driver's range of vision, even though at a considerable distance ahead or at a low intensity, decreases his acuity of vision to such an extent that the possibility of accident is materially increased. In fact, the majority of serious road accidents at night can be charged to too much improperly directed light rather than to insufficient light. The practice of dimming headlights in passing cars is becoming universal, but it does not entirely relieve the trouble. Ordinarily, the dimmed headlight does not give sufficient intensity to properly light the road at a time when good light is of supreme importance.

Special Features Required for Satisfactory Road Lighting.

The lighting system that will fulfill the above conditions must necessarily obtain some special features. Naturally, a most important factor in the system is the lighting unit, which must be specially designed for the purpose. A lighting unit recently designed by the George Cutter Works of Westinghouse Electric & Manufacturing Co., South Bend, Ind., has served to meet these exacting requirements. It consists, essentially, of a porcelain housing which contains the series socket for a type C incandescent lamp, and a reflector. The unit is arranged for suspension from a series of interchangeable fittings to be fastened to brackets, mast arms or span wires as mounting conditions require. The reflector is made of porcelain-enameled steel, reflective white inside, with a bottle green enamel on the outside. Its shape is peculiar, being made to throw the light on a long stretch of road without loss in the fields on either side. This unit, placed at a proper height above the road surface and spaced at proper intervals, will light the roadway at a fairly uniform intensity—a very desirable condition for the driver. Patches of light, as under the ordinary street lighting unit, with darker stretches between are very tiresome and injurious to the driver's eyes when traveling over long stretches of road at a fair rate of speed. The effect upon the eyes is the same as that from a slowly flickering light to which the pupils of the eyes are continually laboring to adjust themselves.

Another important feature of this unit is the angle of cutoff which eliminates glare. Practical mounting heights do not permit the unit to be placed above the driver's range of vision, so it is very important that his eyes be shielded from the high intensity of the light from the lantern. This is accomplished by shaping the edge of the reflector so that the light in a line parallel to the direction of travel is cut off through an angle of 14 deg. below the horizontal—the angle which has been determined by exhaustive tests to be the most practical.

Reflections from the polished road surface are just as disturbing to the eyes as direct light from the lighting unit itself. It is noteworthy that this reflector cuts off all light rays which would otherwise be reflected direct to the driver's eyes from the road surface or from the mirage-like mirror so often appearing just above the road surface during the summer season. The distribution of power to the lighting unit is of importance, but will require no apparatus other than that now in use for long distance lighting circuits. The pole-mounting moving-coil regulator for series lighting circuits, recently placed on the market will, no doubt, be widely used in highway lighting because of its adaptability to this class of service.

MANY ELECTRIC LINES ARE NOW BEING BUILT.

Due apparently to the marked increase in price of fuel which has taken place during the last few years, steam railroads all over the world are studying the possibilities of electrification as a means of lowering operating expenses. Most of the leading countries in Europe have announced plans either to increase the present mileage of electrified steam railways or to carry out such work where hitherto electrification was not regarded as economically feasible. In South America, Brazil and Chile either have work now under construction or are about to let contracts for such projects. In Asia, Japan and India are both making investigations with a view to electrifying certain suburban or heavy-traffic sections. In Australia the suburban lines out of Melbourne have been in process of electrification for some years, and other projects in that country are under discussion. In Africa the question of electrifying steam railways of the Union of South Africa has reached the stage where bids have been invited and are in the hands of the consulting engineers, who are expected before long to place some part of the initial construction contract.

In the past, whenever the question of electrification has been taken up, the matter of increasing the capacity of a section of steam railway has probably been the greater factor, rather than reduction in operating expenses. Now the high price of coal throughout the world has brought the latter factor into the greater prominence. It is interesting to note that in many of the larger countries abroad the heavy trunk-line electrification projects in the United States have been very carefully studied and are very frequently referred to by foreign consulting engineers in their reports, and that in several instances standard American plans have been adopted practically complete by engineers advising foreign governments on steam railway electrification. It is believed that the experience of American manufacturers in developing reliable heavy railroad equipment in this country will be of considerable help in negotiating a foreign contract.

One of the large electric lighting companies has figured out what 1 ct. worth of electricity at $0.10 per kw-hr. will do. It is found that it will operate a vacuum cleaner for 25 min., a washing machine for 30 min., a 6-lb. flatiron for 15 min., a toaster long enough to make 10 slices of toast, an electric percolator long enough to make three cups of coffee; it will run a sewing machine for 2 hrs., a 12-in. fan for 1 hr., a luminous 600-watt radiator for 10 min., and an electric curling iron once a day for 2 wks. If milady wishes to dry her hair by electricity, a penny's worth will operate her electric hair drier for 2 hrs., or it will supply current for 20-min. electric vibrator treatments daily for a week.

Types of Circuits Employed in Street Lighting—Part II.*

Design of Circuits to Facilitate Rearrangement in Emergency and Testing Reduces Cost of Operation and Increases Grade of Service Rendered—Examples of Maintenance on Specific System

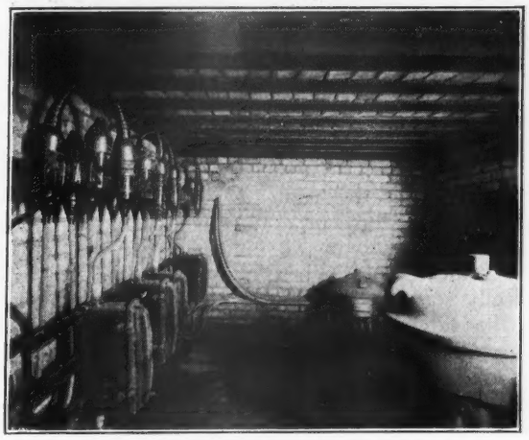
By C. H. SHEPHERD
Consulting Engineer, Chicago.

Regardless of the quality of material used or the type of construction employed on any high-tension series system trouble will eventually occur, and it has long been a mooted question as to whether or not the expense of installing the necessary devices for locating and sectionalizing such trouble is justified. During the years that the writer was in charge of various street lighting systems it became apparent that due to local conditions it was necessary to so construct the various circuits that the locating of trouble would be facilitated. A study of conditions developed the fact that this could best be done by the installation of disconnecting potheads at strategic points in conjunction with the installation and operation of various auxiliary devices which will be hereinafter described. The installation of these potheads not only makes it more easy to locate trouble on any circuit, or to sectionalize trouble which could not be readily cleared by the usual methods, but also afforded great facility in making of the necessary tests which occur frequently in a system of this kind, or which should occur providing an intelligent maintenance policy is enforced on any such system.

One case in particular is that of a street and park lighting system of some 1700 street series lamps which are supplied with power from 18 series 7.5-ampere circuits with voltages ranging from 2000 to 7000. Each circuit has its individual transformer, regulator, oil switch, control panel and instruments, the entire system being supplied from a 12,000-volt, 3-phase power line. From the standpoint of the layout engineer these circuits divide themselves into three main classes; namely, open loop, closed loop and combination.

Potheads Provide Convenient Openings for Testing and Changing Circuits.

In order to properly segregate defective portions of circuits potheads are installed at various points to facilitate not only this operation, but the locating of trouble and maintenance of continuity of service as well. At the feeding points of all loops disconnecting potheads are installed with triple-braided jumpers so that any loop may be cut out and "shorted" out of circuit in case of trouble. At the ends of all loops potheads are installed with ground connections arranged to be made immediately available in case of necessity, and where two circuits run parallel on the same boulevard it is thereby made an easy matter to select for service the two good sides of these circuits or loops in case of the development of a "ground" or "open" on one side of each. The potheads installed at the ends of the circuits are also available for rotation testing and for opening any circuit for capacity tests. Potheads are also installed at the ends of feeder lines on the energy side of the first lamp on each circuit or the last lamp respectively, as the case may be, thereby allowing the feed line to be disconnected and closed across for the purpose of making a bridge test.



View Showing Installation of Potheads in Transformer Manhole.

When it is necessary to interrupt the continuity of the cable sheath in places where potheads, triple-braided lamp legs, or similar devices are installed the cable sheath is bonded across the break and pothead sleeves belled at the triple-braided end and wiped into a sealed joint 18 ins. back of the bell are installed, thus effectually taking care of the accumulation of static at these points. In cases where by polarity tests the cable sheath is shown to be positive to ground, ground rods are installed and bounded to the cable sheath, but in places where the cable sheath shows negative to ground the cable is either insulated or no action is taken at all where the process of insulating would be too difficult.

In checking the rotation of lamps on circuits a "ground" is placed at the center of the loop in question and another "ground" placed on the right or left, respectively, of the circuit at the switchboard. This connection cuts out the lamps on the grounded leg, allowing the lamps on the ungrounded leg to burn with the feeder transformer at half tap making it a very easy matter

*The first part of this article appeared on p. 388 of the Sept. 10, 1921, issue of Electrical Review.

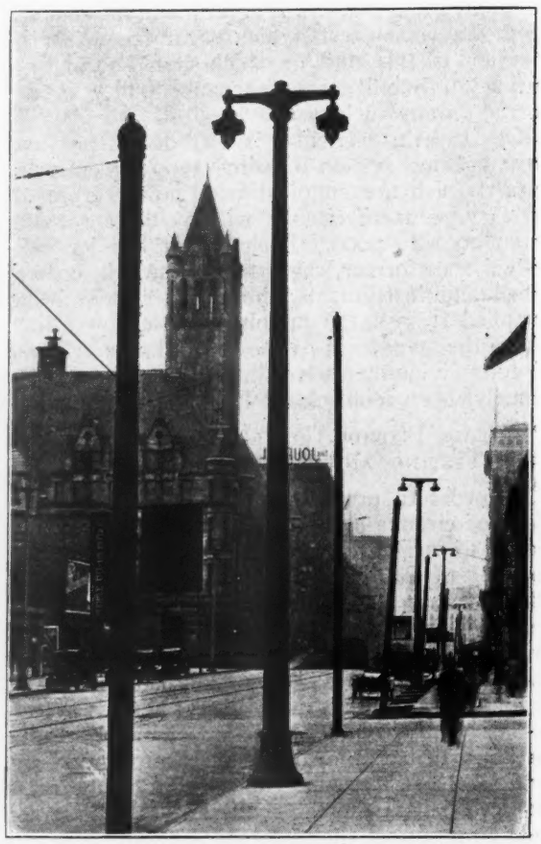
Trimming Flaming Arc Lamp Hung on Combination Cutout and Hanger.

to check up a circuit diagram by merely running along the circuit in a machine and checking off the lamps on the right or left according to whether they burn or not. On long closed loops sometimes involving an entire circuit the lamps are connected on the step-by-step method, or electrically staggered on the line cables, this method cutting down the greatest length of cable between lamps to two lamp spans. Obviously this construction facilitates the locations of trouble and reduces the necessary "cuts" to a minimum. The rotation of lamps is checked after each change by the method outlined above.

Series Circuits on This System Are Always Treated as Condensers.

Series circuits on the system under consideration are always treated as condensers, the conductor forming one plate and the grounded cable sheath the other. In order to determine whether or not these circuits should be operated grounded or ungrounded, potential gradient tests were made covering each circuit in question. On ungrounded circuits the potential gradient is almost uniform, due to the fact that there is no ground on the circuit allowing the zero-potential point to shift position to compensate for the changes in reactance on the circuit on account of lamp burnouts, regulator movements, etc., and the prevailing electrostatic conditions throughout the entire length of the circuit including the feeder cable. With the apparent electrical center of the circuit grounded the potential gradient is unbalanced and shows a lack of uniformity due to the fact that the zero-potential point is fixed by being grounded, and the former flexibility and freedom for adjustment of the ungrounded circuit in response to changes of electrostatic and electromagnetic conditions is thereby seriously hampered. Such unbalances due to action of the regulator and to changes in electrostatic capacity caused by variations in the specified inductive capacity of the various dialectrics used in the cable insulation along the circuits are apparent in making such a test.

After investigation of the potential gradient situation obtaining on this system it was evident that the advantages of an ungrounded system outweighed those inherent to a grounded system, and it was decided to operate the system ungrounded as it was a very easy matter to place grounds at the salient point of the circuit wherever necessary. In the early operating period of this system the series circuits were made up of 7.5-ampere closed carbon arc lamps with an efficiency no better than the average for these units. Some 5 or 6 yrs. ago the arc lamps were eliminated and a compensator construction substituted on all existing standards, each compensator supplying power to a 15-ampere, 400-cp. type C lamp. As extensions to the system were being made it was decided after certain experiments to feed lamps on all new construction from the secondary side of suitable series-multiple transformers, and after a series of experiments and tests had been conducted a standard transformer was adopted and installed from that time on. The transformers have a partly open core, the primary and secondary windings being insulated by a dielectric having a strength of 20,000 volts at 60 cycle. The connections were made with tinned-brass wiping sleeves which were fitted with suitable lead sleeves soldered on, wiped to the cable sheath, properly insulated, filled, refilled and sealed, thus establishing a bell at each terminal and a 100% cable sheath bond. This construction operates as well submerged as



High Concrete Lamp Pole Carrying Units Fed From Underground Lines.

dry, no static trouble being experienced as the secondaries are not grounded but are carried in 600-volt rubber and lead cable direct to the lamp.

The safety-island light system is fed by transformers of similar construction but of a different suitable characteristic and capacity, each transformer having as a secondary load five 56-watt railway type B lamps. The capacity of the type C transformer is approximately 225 watts with a regulation within 0.5% of normal full-load current and a rise in pressure from full load to open secondary of not more than 200% of normal, the wattage expressed as a figure including line loss averaging about 272 watts per unit. The island-light transformers, on the other hand, have a capacity of approximately 220 watts with a very low power-factor and a rise in pressure from full load to open secondary of not more than 50% normal full-load voltage.

By the elimination of the arc lamps and substitution of the devices mentioned above each circuit has been made metallically solid, allowing a number of advantages which did not exist previous to the time mentioned. At the present time three continuity devices are in service—film cut-outs, compensators, and series-multiple transformers. About 2 yrs. ago a testing ground bus with suitable quick-connecting devices was installed on the switchboard, allowing certain and rapid "trouble shooting" by means of using the lamps themselves as indicators. This process is extremely simple, it being only necessary in the case of a ground on the exterior circuits to connect to the ground bus the side of the circuit nearest to the trouble as determined by a current test. The circuit is then cut in at half-tap, the lamps on the grounded side naturally being cut out, and a quick trip is made to the last lamp out and the first lamp burning. This point being reached it is quickly checked by a reversal of the ground at the switchboard, the defective cable being then narrowed down to two lamp spans after which the trouble is quickly located at the exact point by a visual test magnet or bridge. In the winter of 1918 there were 161 cases of trouble on the system and the average time of location was 17 min.

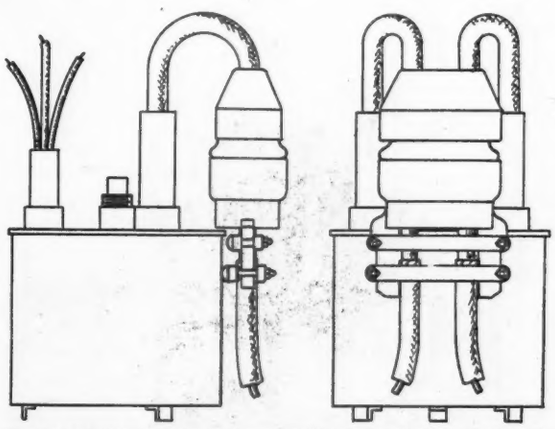
Trimming Flaming Arc Lamp From Ladder and Pole Step.

Laying Armored Cable for Lighting Circuit in Parkway.

As stated above, any feeder lines may be disconnected and "shorted" out at the feeder point, leaving this line available in case of trouble for a Murray loop or Varley loop test or both. Open circuits on similar lines may be easily located by disconnecting sections by the use of a capacity bridge or by breaking down the insulation at the open point by high voltage to ground.

As an adjunct to the above testing arrangements a progressive total of cable lengths from right to left and from left to right on each series circuit was prepared which greatly facilitated the locating of points at any given distance from the source of supply of any circuit when such distance is indicated by means of a bridge or loop test. The operation of a pothead trouble station is quite simple, but the operator must know and understand the various circuits and connections in order to avoid errors that might prove disastrous to both the man and the equipment. In fact, unfortunate accidents have actually taken place because of both ignorance and neglect.

Ordinary intelligence on the part of the trouble man will safeguard him against such eventualities, at the same time protecting the apparatus and tending toward the maintenance and continuity of service. The construction of a metallically solid circuit requires not only the calibration of the circuit itself, but also the ability to open such cir-



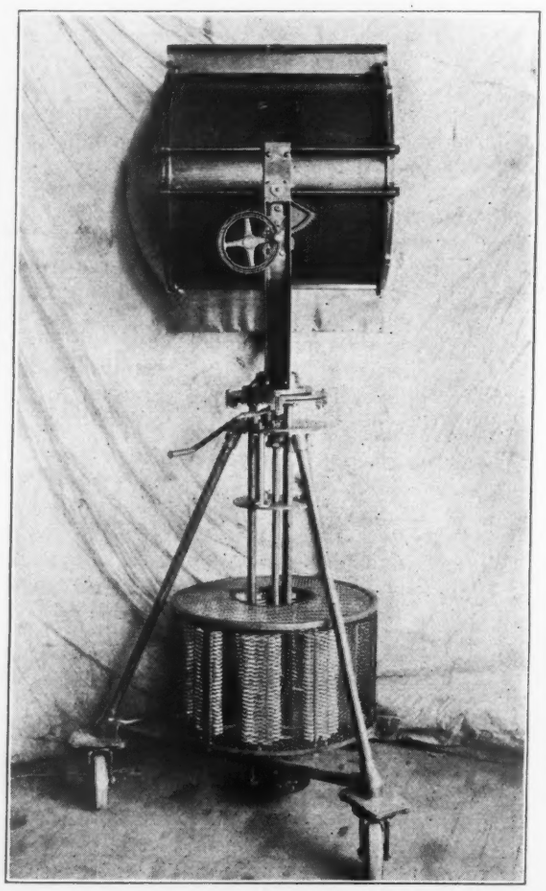
Series-Multiple Transformer With 2-Conductor Pothead Connection.

cuits at points which have a known distance from the station terminals in order to accurately check the capacity bridge tests or to ground any circuit at such known points in order to check the Varley or Murray loop tests. The success of this system was proven beyond a doubt, and the original cost compared to the actual cash saving accomplished in the quicker location of trouble and the effect on the minds of the public by the maintenance and continuity of service establishes beyond a doubt the justification for the installation of such equipment.

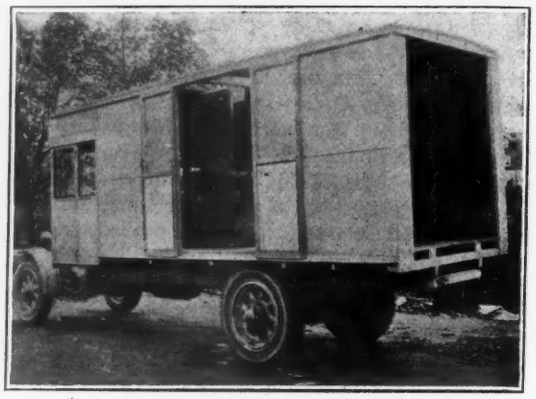
HIGH-INTENSITY SEARCHLIGHT FOR MOVING PICTURES.

Generating Equipment Mounted on Truck Makes Lighting Effects Available Out of Doors Wherever Required.

The constantly growing use of artificial illumination for taking moving pictures, which has come about through the impossibility of obtaining proper effects by the use of daylight, has led to the development of a number of special devices. One of the latest of these is a high-intensity spotlight, developed by the General Electric Co. The light, which is a small searchlight in general appearance and construction, is not only useful in the studio to eliminate shadows caused by other forms of light and to get special effects, but can be used for the same purposes outdoors. It consists of a projector having a 24-in. mirror, inside of which are mounted the carbons and feed mechanism for the arc. The latter is entirely automatic in operation, the carbon being fed by a small shunt motor connected across the arc. By this method proper regulation is obtained because changes in the length of the arc are immediately reflected in the motor voltage, causing it to take proper corrective measures automatically. In addition to being fed forward the positive carbon is rotated, which insures the burning of a large and even crater always maintained at the focal point of the mirror. The arc may be struck magnetically by means of a push button on the end of a 10-ft. cord, which allows for remote control. It is also possible to adjust the carbons manually by handles independently of the motor.



Special Lamp for Moving Picture Production Work.



Truck-Carrying Generator to Supply Energy to Searchlight.

The mirror is of glass, ground, polished and heavily silvered, being flexibly mounted in a ring and protected by a dome to allow for expansion and prevent possible injury from concussion. The cast aluminum barrel of the projector is mounted on a movable tripod fitted with an elevating shaft and gear so that a range of from 6 to 9 ft. above the floor can be obtained as desired. The tripod also carries a rheostat for voltage control and the contactor which operates the magnetic striking apparatus.

The light can be used either as a spot or flood light by changing the focus of the beam, or if desired it can be used as a prime flat light by removing the mirror which focuses the rays. It is particularly adaptable where moonlight or sunlight coming through a window or where the illumination of a large setting is desired. It is also useful for back lighting. As the whole outfit weighs only about 500 lbs. it is readily moved about to whatever position is desired. When used out of doors on location it is supplied with power by a gasoline motor-driven generator, the whole power plant being carried on an automobile truck.

GOVERNMENT POWER SURVEY.

Secretary Fall and the Washington government are having a geologic survey made of the North Atlantic coast region with a view to encouraging the development of all available water power and the construction of a super-power connection between all existing plants. The movement is being made by the government as supplemental to the activities of the operating companies and is in no way a government-owned enterprise.

Illuminating Engineers Predict Improved Business

Talks and Papers Presented at Special Meeting of Chicago Chapter of the Illuminating Engineering Society Indicate Better Lighting Conditions as a Development of the Coming Year

Better lighting, better fixtures and an increased business in all branches of the lighting industry were the promises held out for the coming year by the various representative speakers at the Nov. 30 meeting of the Chicago branch of the Illuminating Engineering Society. Manufacturers, contractors, engineers and the central stations were represented by special speakers, each presenting the angles of the proposition that appealed to his particular branch of the industry. A. N. Brown of the Westinghouse Lamp Co. gave a comprehensive outline of the practices which his organization had instituted to aid in the securing of new business and the improving of the old.

The Westinghouse company is now in the midst of a store-lighting campaign. The sales department is now securing the required field data at first hand, and the engineering department prepares complete and orderly specifications on the basis of the data gathered. Liberal use is made of the foot-candle meter in this work. The larger customers are urged to make liberal use of these meters as a guide to their own requirements. The work done up to the present time shows a decided tendency to increase the foot-candle intensities employed, indicating the use of more lamps, more fixtures and more energy. In concluding, Mr. Brown told of a recent industrial installation where the illumination had been raised from an average of 2 to 10 foot-candles with an increase in plant output of 20%.

C. E. Verhunce, of R. Williamson & Co., told about the prospects for the coming year as seen by the manufacturers of fixtures. Probably the most important statement by Mr. Verhunce was his announcement that for the past 30 days it had been necessary for his organization to let up on its sales activity in order to allow the production department to catch up with orders already in hand. Such a condition has been brought about as a result of a progressive policy involving the production of equipment at prices at which the market will buy. According to Mr. Verhunce, but little attention has been paid in the past to the proper cultivation of the great field of residence illumination, and this field is bound to produce an enormous quantity of business when properly cultivated.

The contractors of Chicago were represented by T. O. Meade, of the Meade Electric Co. Mr. Meade expressed appreciation for the help being rendered the contractors by the manufacturing and central-station companies, and stated that it was possible to do business even in the dull periods of the recent past. Mr. Meade called attention to the fact that lighting business can be secured much better by means of an actual demonstration or display than by the presentation of a quantity of data.

E. W. Lloyd, of the Commonwealth Edison Co., presented figures to prove beyond a doubt that the lighting business was growing at a rapid rate. He quoted figures to show that his company had increased the sale of energy for residence lighting by 21.8% from Oct., 1920, to Oct., 1921. Within the period from Jan. 1, 1921, to Nov. 31, the company has taken on 30,000 residence customers and 9000 commercial lighting customers, and every month in that period has shown an increase in lighting business over the previous month. His closing remarks were to the effect that nothing had been done in the past compared with the existing possibilities.

W. J. Nealy, of the Frank D. Chase Co., presented a prepared paper on "Practical Progress in Industrial Lighting." This paper is reproduced in substance below:

Practical Progress in Industrial Lighting From Industrial Engineer's Standpoint.

"Industrial lighting deserves the serious consideration of wideawake executives who are aiming to promote safer, healthier and more cheerful working conditions, to reduce spoiled materials, and to stimulate production. Adequate illumination does all of these things. In view of this fact it is gratifying to find that owners are more readily convinced of the desirability of correct intensities than they were a few years ago. Most of the progress in the illuminating industry, and the advance in public thought regarding correct illumination, is due to the splendid work of the various illuminating societies and the manufacturers of lighting equipment. Of course, there are always exceptions to a broad general statement such as this, but, no doubt, you are familiar with recent instances where architects' specifications on new buildings called for the use of equipment already antiquated.

"On the other hand, some architects' offices and most of the engineering concerns are keenly alive to the possibilities of better illumination and are always seeking to provide for their clients the most recent developments and efficient equipment along this line. We, now, have little or no difficulty in obtaining an owner's permission to install good average lighting, and we are hopeful that in the very near future we may be able to convince these owners of the advantages of higher intensities such as are now being recommended and which have been proven so desirable in the many tests that have been conducted throughout the country.

"It may be well to set forth briefly how we design a lighting system and thus enable you to

draw your own conclusions as to where assistance is most needed. In making a layout for a new project, or revamping an existing plant to put it on a successful basis, an engineer should always be able to justify his layout and design. High-grade lighting layouts are justifiable from the standpoint of maximum efficient production and safety. These two fundamental reasons could, of course, be further subdivided. Efficiency in production is always desirable in every industry on the score of general economy, but at no time is it more essential than during the periods of keen competition and the present readjustment period.

"At present inefficiency is more inexcusable than ever before, because it is the direct upholder of high cost and high prices. Generous windows and skylights well placed and equipped so as to obviate the sun's glare pay in the excellence of daylight secured. Modern lighting systems also pay handsomely in the excellence of artificial lighting that is ready at any moment to replace deficiencies of natural lighting and to permit operation at any hour of the day with an efficiency equal to that of broad daylight.

"Such marked progress has been made in lamps and reflectors within the last few years that lighting equipment which has been in service for any length of time may well be considered out of date. This means that plants operated with incorrectly designed or obsolete lighting systems are behind the times in a manner which seriously affects their output.

"In designing and laying out a lighting system for an industrial plant the first step is to make a careful study of the building construction regarding the type of building and the method by which the various outlets must be installed. A careful check must be made of the various areas to be lighted and the details of the structure, especially as applied to steel-frame buildings, to determine the various points where interferences are possible, such as steel members and bracings. Careful note must be made of all machine equipment mounted overhead, all piping systems, line shafting equipment, etc., for interferences. Due consideration must be given to craneways, monorail systems, and anything that has a bearing on the possible mounting height or otherwise affects the spacing ratio of the units.

"After becoming thoroughly familiar with the construction details of the building and having determined possible mounting heights and spacing distances of lamps the next step is to determine the exact operations which will be performed in the various areas and select a suitable and productive lighting intensity. Having determined the required intensity of illumination, next select the type of lighting best adapted to the particular location, determine the location and number of outlets, and then by standard formulae the size of the lamps can be readily computed.

"There are many special requirements which must be given due consideration, of course, such as local or drop lighting on special or close work and plug outlets and switching of the various lighting circuits to obtain satisfactory lighting of the various areas at a minimum expense; that is, the lights should as much as possible be switched in a line parallel to the production requirements so that if the plant is not working to capacity the various sections that are busy may be lighted without unnecessarily lighting the unused areas.

"After the lighting requirements have been worked up and the contemplated installation as a whole is satisfactory to all concerned the closing step is the calculation of the proper size and routing of the lighting feeders to the various centers of distribution where the cabinets are located. The importance of correctly calculated feeders is often overlooked, and an otherwise excellent installation is thus seriously affected. The efficiency of lamps varies materially with variations in voltage, and a reduction of about 5% in voltage will give a reduction of about 15% in lamp efficiency. The importance, then, of keeping the voltage drop in the system uniform and at a minimum is easily seen. The maximum permissible drop should be computed to the centers of distribution so that the voltage at the cabinets is of the same value for all points of the building. This in turn would insure that the lamps at all points would operate at the same voltage and therefore, at the same intensity.

"After the system has been carefully and properly designed and specifications carefully drawn the next step towards the proper completion is to see that the installation work is done by competent people in full accord with the engineer's or architect's plans and specifications.

"While the total depreciation of a lighting system over a given period will, of course, vary widely experience has shown that a factor of 1.2 for clean location and very clean operation—16.66% loss—and a factor of 1.5 for dirty and relatively dirty operation—33% loss—may be used with assurance of satisfactory result, provided, *and this is of the greatest importance,* that a schedule of regular and frequent cleaning be adopted and is adhered to. Thus, it seems that no matter how carefully engineered or well laid out a lighting system may be its continued success depends entirely on the operating crew, and the benefits to be obtained from good lighting will offset any cost of maintenance that may be entailed.

"The various equipment manufacturers have simplified the designing work in connection with any lighting system, and without their assistance architects or engineers would be seriously handicapped as they are not in a position to conduct the extensive tests and obtain data which is so necessary in the solving of our lighting problems. As was previously mentioned, it is necessary to use as careful judgment in selecting the contractor to install a lighting system as is required to design some contractors who do not seem to appreciate the system. It is a regrettable fact that there are the benefits of high grade work, and who are ever ready to cheapen the job by substitution of cheap, inferior and poorly designed equipment. In many cases they are as lacking in information regarding the advantages of good lighting as an ordinary layman. There are, however, many high-grade contractors who maintain in their organization very competent engineers. These firms appreciate and do good work and are ready to assist the designers of buildings at all times. They play an important part in solving the problem of the small architect, for it is often their duty to design the lighting requirements of the buildings which are planned by these smaller concerns."

The Illumination of Stained-Glass Church Windows

Lighting From Outside Brings Out Beauty of Windows During Evening Services—Equipment Within Building Makes Stained-Glass Features Attractive to Public Every Night of the Week

By D. S. MYERS

Engineering Department, National Lamp Works, Cleveland, O.

The beautiful stained-glass windows in our churches have a very definite purpose. They diffuse a soft mellow light throughout the interior which creates an atmosphere of quiet—a light that is entirely in harmony with religious worship. The biblical scenes and characters portrayed carry messages rich in sentiment and strong in their appeal, while the skill employed in developing the intricate color combinations is such as to make them valuable simply as works of art. The proportion of the time that actual benefit is derived from these windows is, however, comparatively small since it is only during the Sunday morning service that the congregation sees these windows at their best when light from outside is shining through them. On nights when the interior of the church is lighted the people who pass by can see the beauties of the windows, but the interior illumination planned for other purposes will seldom bring out the details of the window satisfactorily. Moreover, evening meetings are usually over and the churches dark long before the thoroughfares are empty. When one considers that some $20,000,000 are invested in stained-glass windows in this country it seems fitting that the benefits should be extended and broadened so that we may appreciate them more fully.

With this in view a number of churches in Cleveland have installed special lighting systems for their memorial windows, which have proved very effective. Such installations can be arranged to light the window either from within or from without. Lighted from without during evening services the beautiful colors of the windows are brought out as clearly as when daylight is shining through them. A simple system of lighting from within renders the beauties of the window visible to the passerby and permits the window to be lighted on every night of the week.

In lighting windows from without 300- or 500-watt clear type C lamps are used, according to the area of the window. These lamps are equipped

Exterior View of Church Window Lighted From Within by One Floodlighting Projector.

Method of Arranging and Mounting Lighting Units Outside a Window.

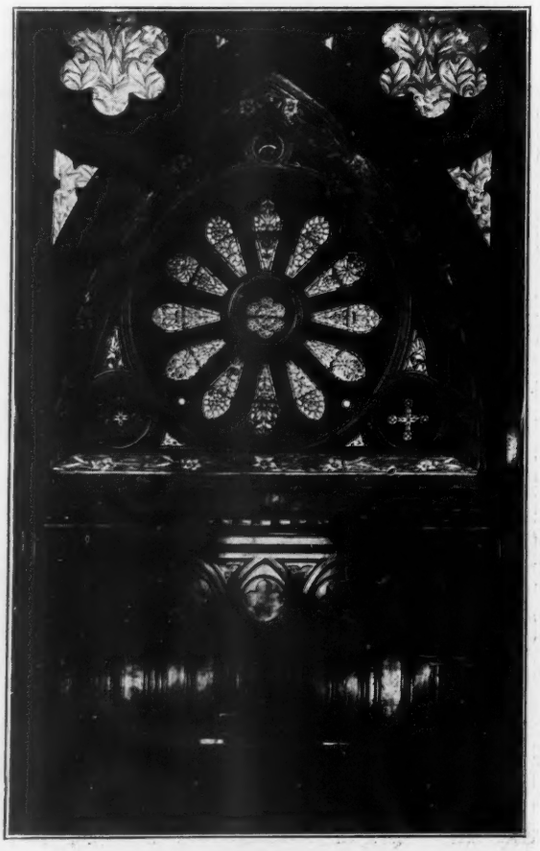
with angle-type reflectors and are mounted on arms or brackets extending 4 or 5 ft. out from the window. It is usually not desirable to mount lighting equipment on the exterior where the windows face the street, as it may mar the general appearance of the building. From 3 to 4 watts per sq. ft. of window area will prove satisfactory where the church interior is not very brightly lighted. Where the interior is more brightly lighted as high as 6 watts per sq. ft. of window area may be required.

Floodlighting projectors provided with a weatherproof casing may be used to accomplish the same result where a roof or some convenient mounting place is available. The projectors should be equipped with 750- or 1000-watt clear type C lamps, according to the window area to be lighted. If a floodlighting projector with the ordinary cover glass throwing a round spot of light is used for high narrow windows there will be a considerable loss of light, since a portion of the light will fall on the wall instead of the window area. This can be corrected by replacing the clear cover glass of the unit with the spread lens which will draw the round spot of light into a band of light and direct the greater portion of it to the window surface. In case no such lens is readily obtainable one can be easily made from standard ⅛-in. ribbed glass.

In lighting a window from the interior of the church the same general principles apply as when lighting it from without. However, it is necessary that the lighting equipment be made as inconspicuous as possible so that it will not detract from the architectural beauty of the church. Various places, such as an arch or a last row of seats, can be conveniently utilized for concealing a number of units. Angle reflectors of the mirrored-glass type, such as are used for display window lighting, are usually satisfactory. About the same wattage as is required for exterior lighting will in general be satisfactory for the interior installation. However, where the church is surrounded by brightly lighted display windows and street lamps 3 to 5 watts per sq. ft. of area lighted will, perhaps, be necessary. Clear type C lamps of the 100- or 150-watt size will be satisfactory for this service.

Where it is necessary to locate the light source a considerable distance from the window floodlighting units should be used. The same wattage per square foot as is used for the exterior installation will usually be satisfactory. Some of the locations in which a floodlighting unit might be concealed are the organ and choir lofts, balconies, on ceiling beams, behind arches, or perhaps under the pulpit. In some cases the unit might even be located on the floor near the pulpit and provided with a neat box with which it could be covered during the church services. The cover of the box should be hinged so that it could be readily folded back to expose the projector when it is desired to illuminate the window. Where there is no place available to conveniently conceal the projector a portable unit may be used. This unit should be equipped with a base large enough to insure stability and may be located at any suitable point in the building. During the services, or at any other time when the auditorium is to be used, the unit should be removed by the caretaker of the building.

It is important that a convenient arrangement of switching be installed with the system. Where there is a caretaker in charge of the building the turning on of the lights may be taken care of by him before leaving the church in the evening, and



Interior View of Stained-Glass Window Lighted From Without.

a time switch employed to turn the current off at the desired time. Where there is no caretaker time switches will be found most convenient to turn the lights both on and off. A switch located on the outside of the building could be taken care of by a watchman if there is such service available. Time switches are not necessary for units installed to illuminate the windows from without

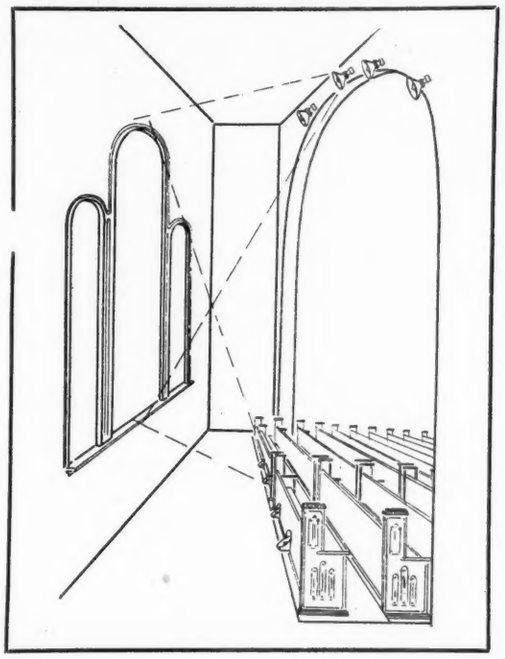


Diagram Showing an Interior Lighting Arrangement.

because these units are lighted only when the church auditorium is in use.

It is important that the equipment be kept clean, for a slight collection of dust and dirt will materially reduce its effectiveness. The window itself should, of course, also be kept clean. Burned out lamps will cause a "spotty" appearance on the window and should therefore be promptly replaced. In locating the lighting units consideration should be given to their accessibility that proper maintenance may be facilitated.

MARINE APPLIANCES EXHIBITED AT NEW YORK SHOW.

Turbine Pumps, Marine Economizers, Turboblowers and Sectional Views of Shipboard Valves Among Displays at Marine Exposition.

A majority of the attendance at the annual Marine Exposition held in New York City last month consisted not only of persons interested in marine outfits but those actually concerned in the marine business and, therefore the show could be termed in every sense of the word a success. The show this year was essentially an exhibit of marine appliances and no attempt was made to put on view actual sea-going craft. There were a large number of exhibitors and a few of the prominent manufacturers showing interesting displays were:

The Worthington Pump & Machinery Corp., 115 Broadway, New York City, showed two models of a 3-stage turbine boiler feed pump, a circulating water pump and a Blake-Knowles type vertical simplex piston pattern boiler feed pump similar to the kind that was newly designed throughout, patterns made, castings poured, parts machined, machines assembled, thoroughly tested and delivered within 5 wks. of receipt of order from the U. S. Shipping Board. It is interesting to note that one of the ships equipped with these rapid fire built pumps has set a record for a quick passage.

A Reilly evaporating plant for distilling fresh water from salt and showing sectional construction featured the exhibit of the Griscom-Russell Co., 90 West street, New York City. Power Specialty Co., 115 Broadway, New York City, displayed parts of the interior construction of the Foster marine economizers and the Texas Co., 17 Battery place, New York City, had an exhibit of "Texaco" marine oils. In the space occupied by the Johns-Manville, Inc., Madison avenue and 41st street, New York City, was displayed magnesium products, packing. standardization and a system of refrigeration.

The American Brass Co., Waterbury, Conn., had an elaborate exhibit of its brass products, including "Ambrac" headplates, tobin bronze, naval brass and muntz metal for marine and stationary condensers. Sectional views of shipboard valves, a marine oil burner and a motion picture on making seamless drawn tubes were shown by Babcock & Wilcox Co., 85 Liberty street, New York City.

The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., operated a wireless telephone outfit, amplifying music and news from its Newark, N. J., broadcasting station. A 25-hp. motor built for use with deck machinery and of waterproof construction capable of withstanding severe weather conditions occupied the booth of the General Electric Co., Schenectady, N. Y.

The features of the B. F. Sturtevant Co., Boston, exhibit were the latest types of turboblowers and a gasoline generating set with a cooling system including an automobile type radiator and a fan. The display of the American Engineering Co., Philadelphia, consisted of a windlass, portable hoist, gypsy, hydraulic steerer and hydraulic reduction gear. All of this apparatus is designed for electrical operation.

The proposed world-wide naval disarmament was naturally a topic of discussion among the marine manufacturers and while it was universally agreed that the movement was in the right direction, no one felt that it would curtail the marine construction business, but rather divert to merchant ship development the expert minds now formulating naval construction designs.

OPEN SECOND SCHOOL FOR SAFETY SUPERVISORS.

The Chicago Safety Council has announced the opening of its second school for safety supervisors at 7:30 p. m. Tuesday, Dec. 6, in the auditorium of the Central Y. M. C. A. building, 19 South La Salle street. The school provides instruction in the principles and practices of safety, fire prevention, health and sanitation, and first aid, by means of 14 evening meetings held on alternate Tuesday evenings. There are no entrance requirements and the service is free. Each meeting deals with a specific subject of interest

and value to managers, superintendents, safety supervisors and foremen in industrial, railroad and public utility service. The plan is of value alike to men in charge of safety and kindred activities, and who desire further training in this field, and to those in other occupations who desire training to equip them to undertake work of this character.

The meetings will be addressed by experts, printed pamphlets outlining the subjects dealt with being distributed without cost and round-table discussions conducted. Opportunity is thus afforded to receive a liberal education in these subjects of rapidly increasing importance at a minimum expenditure of time and effort. In addition to the formal program at the opening meeting Dec. 6, addresses will be made by Arthur H. Young, president, National Safety Council; General Abel Davis, vice-president, Chicago Association of Commerce, and Wm. Otter, president, Chicago Safety Council.

FEDERATION OF CENTRAL AMERICA RECENTLY FORMED.

Credit Standing of Separate Governments Strengthened—Future Utility Developments Possible With Improved Financial Situation.

Great opportunities for the economic development of Central America may result from the newly formed federation of states in that region, the National Bank of Commerce in New York believes, provided the association proves a strong and stable political unit. In the December number of its magazine, *Commerce Monthly,* the bank urges that it is the part of the rest of the world to welcome and encourage the new republic.

The Federation of Central America, which began functioning on Oct. 10, 1921, comprises Guatemala, Honduras and Salvador, and "represents a total population of nearly 4,500,000 and an area of 101,675 sq. mi.," *Commerce Monthly* says. "The entrance of Nicaragua and Costa Rica would increase the area by over 72,000 sq. mi. and the population by more than 1,000,000, and in the latter respect would give the complete federation the fifth place among Latin-American nations.

"At the present time Central America is of importance to the United States chiefly as the source of most of the banana supply and as a small market for cotton goods, but the possibilities of this region are far greater than anything yet accomplished. Although there is a considerable proportion of mountainous or waste land, the rest is exceedingly fertile and adapted to a great variety of crops, and there are important mineral resources as yet almost untouched and dense forests of mahogany, cedar and other valuable woods. Economic development, however, is dependent upon improved transportation and banking facilities, better social conditions and security from devastating wars, all of which in turn depend primarily upon a condition of political stability the attainment of which is one of the important objects of the present federation.

"The transportation facilities of the Isthmus, as greatly improved as they have been during the past two decades, are still entirely inadequate. There are many large and rich sections of Central America entirely without railroads or even passable roads. It is the almost complete lack of facilities for intercommunication that accounts in large part for the slight volume of trade between the states. The total mileage of railroad in operation in Central America in 1916 was over 1700. Later careful estimates are not available, but it is probable that there are still less than 2000 mi. of railroad in the five republics.

"Central American railroads were both difficult and expensive to construct. Nevertheless, the distances are comparatively short and the natural wealth of the region is so great that railroad expansion would assuredly prove attractive to foreign capital if only conditions of peace and security could be assured. Further expansion of railroads, as well as that of all other public utilities, is dependent upon foreign investment, for Central America being primarily agricultural is a region of great shortage of local capital. Difficulty is found in financing locally the regular commercial transactions, and a native supply of long-time investment capital is at present out of the question. It appears, then, that the economic development of the region must depend upon concessions to foreign capitalists and upon government loans.

"As regards the possibility of government loans it is recognized that the various defaults of the separate republics have so injured their credit that they can now borrow only on the most onerous terms. In the event of a successful federation, however, it is felt that governmental economies might be effected that would improve the revenue situation in each country and so assist toward the re-establishment of an improved credit standing.

"It is to the private investor, however, that Central America must look primarily for aid in future development. In dealing with him the principle of collective bargaining applies with equal force, for a successful federation could grant concessions on far more favorable terms to itself than could any single republic bidding against the rest. In this case, however, the value of increased bargaining power is dwarfed by the possibility of increased political stability which would be by far the most important result of a successful federation, for to the foreign capitalist a concession from an insecure government has little attraction.

"Despite some doubts as to the practicability of so highly advanced a form of government in consideration of the limited political education of the majority of the people it is the part of the rest of the world to welcome and encourage any such serious attempt to better the political and economic conditions of the Isthmus as the present federation, and to hope that with the success of the experiment the other two republics will see fit to join forces with their sister states. A strong and stable federation would be a powerful factor for increased prosperity in Central America and by peace and prosperity in Central America the whole world will be the gainer."

A wagon cannot go far after one of the wheels comes off. It takes co-operation to make even a wagon go.

Illumination Calculations for Various Planes

Derivation of Equations Showing the Simple Relations Between Illumination Intensities, Source Candlepower, and Dimensions that Can Be Easily Determined in the Field or from Room Plans

By J. H. KURLANDER
Edison Lamp Works, Harrison, N. J.

The writer recently had occasion to make numerous calculations in determining the lighting intensity on the vertical faces of paper-making machines and was struck with the fact that the existing formulae seemed unnecessarily complicated, or were limited as to their application. In endeavoring to minimize the work of calculation somewhat simpler expressions were derived that are applicable not only to the case in hand, but also in other places where it is desired to figure the illumination at particular points on vertical surfaces such as walls. Again, with but little additional work the method can be applied to diagonal planes that are not vertical. In the early days of illuminating engineering calculations of illumination in the horizontal plane were based on the "point-by-point" method, which is at best a tedious process. Now, however, most problems are attacked by the simpler "flux-of-light" method, with the "point-by-point" method in reserve for checking results and for use in special cases.

To date, two methods have been presented for determining intensities on vertical surfaces. In the 1912 transactions of the Illuminating Engineering Society, page 695, is given a graphical method by F. A. Benford, and in the 1915 transactions of the same society, page 593, is found an indirect solution to the problem by the same authority in collaboration with H. E. Mahan. The last solution is a flux method of obtaining the average illumination on floor and ceiling, the remaining light being on the walls.

These two systems of calculation, however, require a series of operations before they can be applied. No simple formula seems to have been developed that would meet all conditions; the commonly quoted formula as given in some textbooks on the subject being limited to one set of conditions only. This will be pointed out later. The formula here presented is based on the "point-by-point" method, but has the advantage of being truly general in nature and of particular service in designing the lighting installations for roundhouses, erecting shops, paper mills, billboards, etc.

In practice calculations are based on measurements made either on the ground or taken from plans. It is obviously easier to make vertical measurements or measurements along a floor or wall rather than diagonal distances, espcially through space. On this account the final formulae are based entirely on distances that can be so determined—for example, vertical distance from the light source to floor; distance from foot of vertical, perpendicularly, to wall; horizontal distance along wall, and elevation of illuminated point above floor.

To return to the original problem, consider a surface S receiving light from a source located at P, a distance d ft. from S and h ft. above the horizontal line m. (Fig. 1.) The line d is assumed to make an angle θ with the vertical h. Any motion of the surface S can be resolved into two

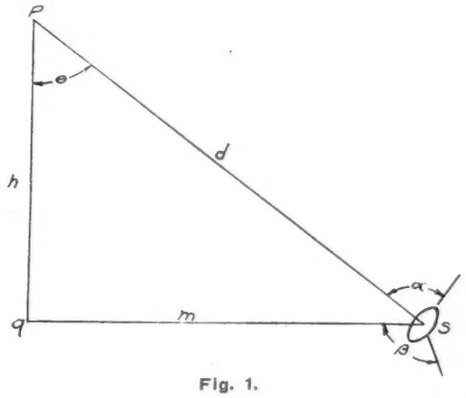


Fig. 1.

angles, a vertical angle α and a horizontal angle β with respect to the given line d and its projection m. The illumination E_o at any point in a plane normal to the light ray d, according to the well known "law of inverse squares," is

$$E_o = \frac{I}{d^2},$$

where I is the candlepower of the source in the direction d, at an angle θ from the vertical.

This expression, applicable to any plane, then becomes

$$E_o = \frac{I}{d^2} \sin \alpha \sin \beta \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

or, since d equals $h/\cos\theta$,

$$E_o = \frac{I}{h^2} \cos^2 \theta \sin \alpha \sin \beta \quad \ldots\ldots\ldots\ldots\ldots (2)$$

This is a general formula for illumination at a given point. For a condition where S is normal to d sin α equals sin 90 deg. which equals 1. In a similar manner sin β equals 1. Therefore,

$$E_o = \frac{I}{h^2} \cos^2 \theta \times 1 \times 1, \text{ since } d = h/\cos\theta.$$

For the case where either a or β equals zero (surface S parallel to the light ray)

$$E_o = \frac{I}{h^2} \cos^2\theta \times 0 \times \sin\beta = 0, \text{ or}$$

$$E_o = \frac{I}{h^2} \cos^2\theta \times \sin a \times 0 = 0.$$

For the case where a equals 90 deg. plus θ and β equals 90 deg. (a horizontal surface)

$$E_o = \frac{I}{h^2} \cos^2\theta \times \sin(90 - \theta) \times \sin 90, \text{ or}$$

$$E_o = \frac{I}{h^2} \cos^3\theta.$$

For the case where a equals θ and β equals 90 deg. (a vertical surface),

$$E_o = \frac{I}{h^2} \cos^2\theta \times \sin\theta \times \sin 90, \text{ or}$$

$$E_o = \frac{I}{m^2} \sin^3\theta.$$

This is the formula often given in the textbooks, but it does not apply to calculations of

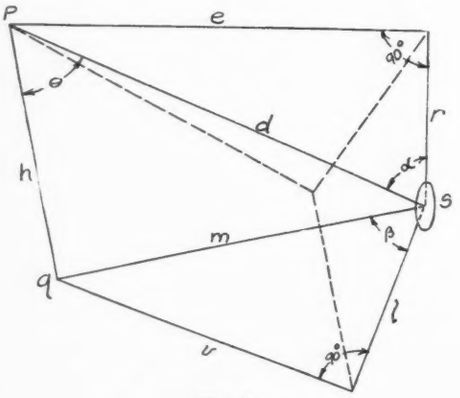


Fig. 2.

illumination on a wall unless the point in question is contained in a plane perpendicular to the wall and passing through the light source. Any other position of the point involves a new value of β and m. In other words, the commonly quoted formula applies to the walls of a cylinder, with radius m, and has no practical value.

for cases where a and β have values between 0 and 90 deg. draw e normal to r, from P, and draw v normal to l from q, as shown in Fig. 2. The following relations then hold:

$$\cos\theta = \frac{h}{d}$$

$$d = \sqrt{h^2 + m^2}$$

$$m^2 = v^2 + l^2$$

$$d = \sqrt{h^2 + v^2 + l^2} \quad \ldots\ldots\ldots\ldots (3)$$

$$\cos\theta = \frac{h}{\sqrt{h^2 + v^2 + l^2}} \quad \ldots\ldots\ldots\ldots (4)$$

This is the angle the light ray makes with the vertical and is used to determine the candlepower in any direction, from a polar curve of a unit giving a symmetrical distribution. For a unit giving an asymmetrical distribution as, for example, an angle reflector, θ (angle from vertical) $= \cos^{-1} \frac{h}{\sqrt{h^2 + v^2 + l^2}}$; σ (angle turned in horizontal plane) $= \tan^{-1} \frac{l}{v}$.

Squaring equation (4) we obtain

$$\cos^2\theta = \frac{h^2}{h^2 + v^2 + l^2} \quad \ldots\ldots\ldots\ldots (5)$$

$$\sin a = \frac{e}{d} \text{ (see Fig. 2)}$$

$$\sin\beta = \frac{v}{m}.$$

Substituting these two values of a and β, and the value of (5), in (2)

$$E_o = \frac{I}{h^2} \times \frac{h^2}{h^2 + v^2 + l^2} \times \frac{e}{d} \times \frac{v}{m}.$$

Canceling and substituting (3) for d,

$$E_o = \frac{I\, e\, v}{m(h^2 + v^2 + l^2)^{3/2}} \quad \ldots\ldots\ldots\ldots (6)$$

This is a general formula for illumination expressed in terms of sides of triangles.

Now, consider a room the walls of which are vertical. Fig. 3 shows a part of this room with conditions as follows: P is the light source or lighting unit; S is a point on the wall; $TFRL$ is a part of the wall; $HKTV$ is a vertical plane perpendicular to the wall; d is a light ray; H equals T equals R equals height of light source above S; F equals L equals distance from S to point on

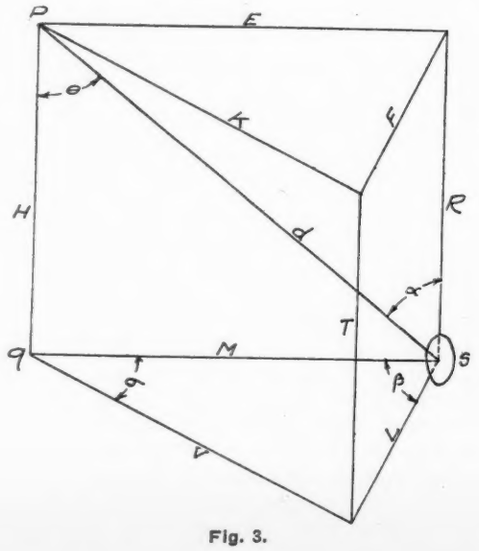


Fig. 3.

wall opposite P; K equals V equals distance from P to wall; E equals M equals shortest horizontal distance from P to S; α is the vertical angle the wall makes with the light ray d, and β is the horizontal angle the wall makes with d. These are the conditions for measuring illumination on vertical surfaces.

Equation (6) now becomes

$$E_v = \frac{I\,M\,V}{M(H^2+V^2+L^2)^{3/2}}, \text{ or}$$

$$E_v = \frac{I\,V}{(H^2+V^2+L^2)^{3/2}} \quad \ldots\ldots\ldots\ldots (7)$$

This is a formula for calculating the intensity of light on any vertical surface.

RELATION BETWEEN E_v AND E_h, EXPRESSED BY EQUATION.

Following the same line of reasoning it is possible to derive a formula for calculating the intensity on a horizontal plane. The conditions are then as follows: β equals 90 deg., $\sin\beta$ equals 1, and $\sin\alpha$ equals $\cos\theta$. Then,

$$E_h = \frac{I}{H^2}\cos^2\theta \sin\alpha \sin\beta \ldots\ldots\ldots\ldots \text{from (2)}$$

$$E_h = \frac{I}{H^2} \times \frac{H^2}{H^2+V^2+L^2} \times \frac{H}{\sqrt{H^2+V^2+L^2}} \text{ or}$$

$$E_h = \frac{I\,H}{(H^2+V^2+L^2)^{3/2}} \quad \ldots\ldots\ldots\ldots (8)$$

This is a formula for calculating the intensity of light on any horizontal plane. Now, to get the relation between E_v and E_h divide (7) by (8). Then,

$$E_v/E_h = \frac{I\,V}{(H^2+V^2+L^2)^{3/2}} \Big/ \frac{I\,H}{(H^2+V^2+L^2)^{3/2}}, \text{ or}$$

$$E_v = \frac{E_h V}{H} \quad \ldots\ldots\ldots\ldots (9)$$

This is a formula for vertical illumination expressed in terms of horizontal illumination, height of lighting unit above illuminated point, and the perpendicular distance from this vertical to the plane containing the point in question.

WESTINGHOUSE TO COVER COUNTRY WITH RADIO ENTERTAINMENT.

On account of the great success and widespread interest that has been the outcome of pioneering in radio telephone broadcasting by the Westinghouse Electric & Manufacturing Co., the company has announced a complete plan of covering the entire United States with a service to the home that will allow anyone anywhere in the country to enjoy the many benefits of radio. The operation of the first radio broadcasting station of its kind in the country at East Pittsburgh, Pa., for the past 12 mo., has opened possibilities hitherto undreamed. From this station alone persons in Canada, New England, Florida, Arizona, the Dakotas, and at greater distances, have been able to enjoy the service. Even in Cuba, Mexico and on ships in the middle Atlantic and on the Gulf of Mexico many have heard the concerts broadcasted from East Pittsburgh.

In order to cover certain parts of the country not reached by this station, and to intensively service other parts, the Westinghouse Co. has laid out a complete program and has already added three large stations. At Springfield, Mass., station WBZ supplies New England; at Newark, N. J., station WJZ takes care of the Middle Atlantic and Southern states, and at Chicago, station KYW services the Middle and Western states.

The fact that the pioneer work of Westinghouse has not been in vain is shown by the fact that, although operating a full year, station KDKA at East Pittsburgh continues to interest more people as time progresses. This is due, however, not so much to the novelty of radio telephone broadcasting, as to the well-planned and diversified program that has been established.

The service started with the transmission of presidential election returns in November, 1920, and has progressed through the broadcasting of phonograph music, entire church services, speeches of prominent men, acts from theaters, musical recitals, reports of boxing contests, results of baseball, football and basketball games, complete minstrel shows, Government market reports, New York stock market reviews, national and international news from the station at East Pittsburgh. At Springfield, Mass., in addition to many of these features there is a periodical talk to farmers about market and stock conditions. A feature of the Newark, N. J., broadcasting station has been bedtime stories for the children, marine information and talks on radio.

The complete transmission of grand opera from the Chicago Opera Co. productions has been the feature of the recently established station on the Commonwealth-Edison building, Chicago. It is predicted that, as a result of the diversified entertainment and information which have been broadcasted through these stations during the past year, this service will prove of expanding value and distinctive interest to mankind.

The programs as conducted by Westinghouse usually last for an hour each evening, and they are announced far enough in advance to enable everyone interested to know what is contemplated. Such stars as Geraldine Farrar, Rachmaninoff, Telmanyi, Clarence Whitehill, Mary Garden, Muratore, Edith Mason and Raisa have performed for the radio and the programs are put on a very high plane. Many speakers of note have talked over the radio, some of them being Secretary of Commerce Herbert Hoover, Assistant Secretary of the Navy Theodore Roosevelt, Secretary of War Weeks and Secretary of Labor Davis.

In order to perfect the transmission of music by radio, Westinghouse engineers have made considerable research studies of the different frequencies of music. A studio has been built especially for the singing of artists so that the reproduction will be accurate. The studio at East Pittsburgh consists of a room 20 by 30 ft. completely lined with burlap and cloth, and without windows, so that there will be no reflection of sound.

EDITORIAL COMMENT

Statement of Publishers of Electrical Review

The ELECTRICAL REVIEW has been sold by the Electrical Review Publishing Company, Inc., to the McGraw-Hill Company, Inc., and will be taken over by the purchaser on January 1st, 1922. This sale includes the *Electrical Blue Book* and the monthly supplement *Electrocraft*.

The ELECTRICAL REVIEW will continue to be published in Chicago and will be issued monthly.

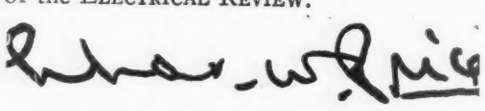
In a brief word to the many respected friends that the publishers of the ELECTRICAL REVIEW believe it possesses, we desire to say that proper publishing economy and efficiency as they relate to the electrical field have seemed to warrant and invite this move. There has grown up an exceptional demand for service, as the expanding industry has become more and more specialized, and the union of the leading journals in that field under one strong and able management will assuredly be beneficial and stimulating to every branch.

We believe the field for a strong industrial electrical journal, such as we understand the ELECTRICAL REVIEW will be made, has developed to the point which calls for specialization, and we further believe that the new publishers and editors will make it the proper fostering exponent of that field and merit full and cordial appreciation.

The Electrical Review Publishing Company with its present officers will continue as a corporation until accounts, which include those for the month of December, are settled. Advertising for December and previous months will be paid to this company as before; all accounts for advertising earned after December 31st, 1921, and all subscriptions at that time remaining unpaid or originating in the month of December will be payable to the McGraw-Hill Company, Inc.

The last word by the present editor, who has for nearly 40 years been at the helm of the ELECTRICAL REVIEW, will appear in the December 31st issue.

And in conclusion let us say that the President of the Electrical Review Publishing Company and his associates extend cordial good will and congratulations to the President of the McGraw-Hill Company and his associates, as well as to the readers of the ELECTRICAL REVIEW.



President,
Electrical Review Publishing Company.

Statement of James H. McGraw

As stated elsewhere by Mr. Price, the McGraw-Hill Company, Inc., has purchased the ELECTRICAL REVIEW and will continue to publish it in Chicago, beginning January, 1922, but as a practical monthly magazine under the title, "Electrical Review and Industrial Engineer." It will form an extension of the work of *Electrical World* whose constructive efforts in the electrical industry extend back now for more than 40 years.

The renamed paper will be devoted to the operation and maintenance of electrical and mechanical systems in mills and factories.

I have come to regard the electrical industry more and more as an opportunity for service, with an ever increasing influence on all phases of community life and development. From the early efforts of scientists and inventors there has grown up the great profession of electrical engineering. Founded upon this profession as a basis there has grown up in turn a far-reaching business—the business of making electrical service available in every nook and corner of the land, of bettering the living conditions in the home, of facilitating the routine of daily life and of mechanically and economically speeding up the wheels of industry.

In this development of the electrical industry, almost from the beginning, the *Electrical World* and the ELECTRICAL REVIEW as contemporary publications have mirrored electricity's progress, interpreted its influence, sought out the ideas and ideals of its leaders, and contended for right principles and right thinking in new lines of achievement. In the proposed co-ordination of these two forces a new avenue for an extended and correlated service is opened, a service that the spirit of the times and the needs of American industry is demanding in a specialized and extended scope.

As in the past, *Electrical World*, the national weekly, will be devoted to the problems of executives and electrical engineers responsible for the administration of policies, for engineering developments, and for practices in all branches of the electrical industry. Its editorial scope, except for broadening, remains unchanged, and embraces (1) the fundamentals of electrical engineering *as a profession*, (2) production, distribution and application of electrical energy *as a convenience service to the public and to industry*, and (3) the broad problems of production and distribution of electrical equipment and merchandise *as a business*.

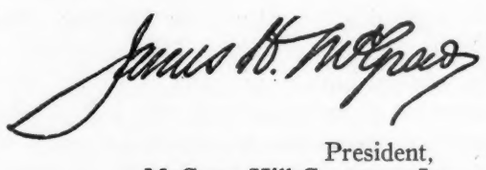
The ELECTRICAL REVIEW under the new title, "Electrical Review and Industrial Engineer," will be devoted to the problems of electrical operation and maintenance in mills and factories, a field which the *Electrical World* will continue to cover as in the past, but from a technical engineering standpoint. With the extended use of electric service in industrial production processes, there has grown a demand for specific and practical information on the operation of electrical systems by those who take up the work where the consulting, designing and installation engineers leave off. To these practical men a service not heretofore available will be provided.

Present subscribers of ELECTRICAL REVIEW will be given an opportunity to select the publication that best suits their needs. They can continue their subscription to the new practical monthly, "Electrical Review and Industrial Engineer," or change to *Electrical World, Electrical Merchandising, Journal of Electricity and Western Industry,* or *Power,* as may be desired.

High ideals of editorial standards and service, and an intimate contact with problems of readers will be the guiding ambition of the editors of the *Electrical World* and "Electrical Review and Industrial Engineer"; in a broad, clearly defined service to all groups of electrical men.

As I look back over the 36 years since I became interested in the electrical industry, from the vantage ground of an intimate contact with the various steps of its development, the opportunity looms greater now than ever before for engineers and electrical business men who hold dominating positions to come forward with initiative and leadership and render a constructive service to American business. Never before were our industries more in need of help—the help that comes from men of big brains and broad vision to conceive, to analyze, to formulate and to execute the plans necessary to set aright the entanglements of our social, industrial, and economic structures. In the electrical industry this desired result can be brought about to its fullest extent only by co-operation. A bigger, broader and better co-operation than has ever existed is essential.

To inspire, to guide and to assist to the uttermost in this work will be the sincere ambition of the editors and the publisher of these two nationally known publications under the direction of the McGraw-Hill Company, Inc.



President,
McGraw-Hill Company, Inc.

Standardizing Metal Fixture Parts

Nothing is more disconcerting when assembling fixture parts which are supposed to be used with each other, than to find they will not assemble properly. Such a fault is unforgivable, particularly in large industrial plants where, on their own products, standardization of parts has been carried to the point that these conditions have been eliminated. Furthermore, such plants have found that after proper standards have been once established it is as easy, if not easier, to maintain them as it is to depart from them. Standardization means the establishment of boundaries, as regards the shape and size, for mating parts in such a manner that parts made within these boundaries will always assemble properly.

To establish the proper boundaries two conditions must be considered. First, the largest internal member must always be small enough to assemble into the smallest external member. Second, the smallest internal member must never be too loose in the largest external member to hold together properly. The difference in size between the largest and smallest internal member, or the smallest and largest external member, is known as the "tolerance" or the amount of variation in size which can be tolerated. When the different parts of an assembled unit are manufactured in different plants, standardization is most essential. Otherwise the customers will be caused to make constant complaints about an unsatisfactory product.

With proper standards once established, the production of such parts is much simplified. Furthermore, in the event of receipt of unsatisfactory parts, the customer himself has the means of determining which parts are in fault and thus is enabled to place the blame where it belongs. In this way the careful and reliable manufacturer is afforded a means of protection while the irresponsible one is exposed.

After standards have been once established it is a simple matter to measure the parts of the tools for producing them, to ascertain whether or not they fall within the boundaries established by such standards. These measurements may be made by any suitable measuring instruments. In general, however, when certain fixed dimensions are constantly used, it is much more economical to measure them with special measuring devices known as gages than it is to use standard measuring tools and make the many computations from these measurements which are so often necessary. A gage is a special measuring tool representing the physical dimensions of some standard part. Their use enables even complicated parts to be measured quickly and accurately. Often they are

so designed that both boundaries, or limits, of an established standard are defined. Such gages are known as "limit gages." The use of such gages enables a part to be measured very quickly to see whether or not it is between the proper boundaries.

Is Standardization a "Bogey"

Whenever the question of standardizing is raised—especially when, as in the case of lighting fixture parts standardization, an entire industry is to be affected—there is usually a wide divergence of opinion among the various firms concerned as to the desirability or practicability of carrying out the idea, according to Charles H. Hofrichter, secretary of the National Council Lighting Fixture Manufacturers, who is working earnestly for the betterment of the industry.

Now, therefore, that so many firms in the lighting fixture field are enthusiastically supporting the standardization plan originated by the National Council Lighting Fixture Manufacturers, and other lighting fixture firms are just as enthusiastically pessimistic (if one may be allowed so apparently contradictory an expression), it is worth while to carefully examine the matter from an unbiased standpoint and see whether the "bogey" of standardization is really as bad as it seems to be at first glance.

It would appear that even those who are objecting to the proposal are ready enough to admit there would be an advantage in having interchangeability throughout the lighting fixture industry if it could be done without a lot of "red tape," and if it could be carried out at a reasonable cost. This attitude of mind has often been induced by a previous severe dose of "efficiency experts" of the kind, so frequently met with, who guarantee to save 10% of time throughout the factory, but who spend 20% to save that 10. These manufacturers naturally take standardization as a condition or practice somewhat on the same lines.

This is not, however, the kind of standardization which the National Council is sponsoring. Their standardization engineer is not attempting to introduce into his plan a number of new measurements. They have realized from the start that true standardization must be based upon practical considerations, and also very largely upon existing dimensions.

In any unstandardized industry, however, there are certain proportions in the mechanical parts used which have proven to be satisfactory through years of experience. These have been adopted—with small variations due to individual preferences—by practically all makers and form, therefore, an excellent basis from which to start. For, unless standardization is based upon proven existing dimensions, it must necessarily fail to be of practical use.

For instance, a 7/32-in. diam. screw may be just as effective in a shade ring as a 3/16-in. diam. screw from a theoretical point of view. Nevertheless, the 3/16-in. standard is more desirable than the 7/32-in. because more people are using it. The first step of the National Council, therefore, was to instruct Mr. D'Olier, its engineer, to make a careful survey and investigation of the local standards in use in various lighting fixture manufacturers' plants. This survey of the field took several months and afforded a basis for the standardization program contemplated by the members after comparison of problems had disclosed such uneconomical conditions.

One of the most interesting points brought out by this investigation was the comparatively small amount of alterations which would be necessary to make the details of the composite parts—screw threads, glassware heels, etc.—conform to the same basic standards. This does not mean that all holder screws, for instance, would be absolutely interchangeable in all ways on any fixture with each other, but it does mean that for one diameter of screw there would be a definite pitch. There is no good reason for having half a dozen different thread standards to one diameter.

In another case two manufacturers were found to be using similar standards in mechanical proportions, except in two sizes. Thus we see that standardization a la National Council does not involve the upheaval and change in manufacturing methods which some fixture makers have anticipated, but rather a collecting and shifting of existing data so that the best of what is already in use may be made available to the world at large—only such minor modifications being made as may prove absolutely necessary.

The National Council's activities are not, of course, confined to this standardization work. It is better known as the organization which produced the great Annual Lighting Fixture Market to be held next year at Milwaukee, Jan. 30-Feb. 4; as the moving spirit in suppressing the reckless price-cutting and piracy of designs formerly rampant in the lighting fixture industry, and as the promoter of co-ordination of thought and co-operation of effort in the lighting fixture business.

It is probable that those of our readers who are arranging to attend the Lighting Fixture Market and convention at Milwaukee will find this standardization program is to be featured somewhat prominently and they will be able to learn for themselves the steady progress which has been, and is being, made towards obtaining interchangeability and its consequent saving of time, money and effort.

THE WEEK'S NEWS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

COMMITTEE DISCUSSES NATIONAL ELECTRICAL CODE PLANS.

An important meeting of the Electrical Committee of the National Fire Protection Association was held in New York City, Dec. 5-6, with Dana Pierce presiding. The purpose of the meeting was to determine plans for the next edition of the National Electrical Code. Proposed modifications will be reported back to the full committee meeting in November, 1922, then published in bulletin form. A hearing will be set for March, 1923, after which the contents of the 1923 Code will be published. An important committee on new developments, consisting of Dana Pierce and the chairmen of 10 standing committees, was formed to consider new practical electrical devices, materials and applications beyond scope of existing Code, and if satisfactory to issue interim credentials for experimentation, subject to the supervision of state, municipal or insurance authorities.

It was decided to develop the scope of the provisions for personal safety as well as fire hazard in the 1923 edition of the Code. Guided by public recognition of these safety principles, modification of 660-watt rules was referred to the proper standing committee with favorable recommendations to cover changes in motion picture wiring rules, also equipment in dusty places and wireless installations. It was decided to eliminate all marine wiring regulations hereafter. Constructive suggestions for changes to be embodied in the new edition of the Code are desired by the committee in charge which should be sent to Dana Pierce, vice-president, Underwriters Laboratories, 25 City Hall place, New York City.

ELECTRICAL CREDIT ASSOCIATION TO MEET NEXT WEEK.

Plans rapidly maturing for the 26th annual meeting of the New York Electrical Credit Association to be held at the Building Trades Club, 30 West 33d street, New York City, on Wednesday evening, Dec. 14, indicate that this will be one of the most important in its history.

The present program calls for the general business meeting at 6 p. m. followed an hour later by the annual dinner during which music will be rendered by the Manhattan Trio. Then with W. R. Conklin, president of the association, acting as toastmaster, addresses will be made by R. Edwards, president, National Electrical Credit Association; Willis H. Booth, vice-president, Guaranty Trust Co., and Edward V. Conwell, general counsel, American Railway Express Co. Between the two last addresses, W. G. Ward will sing a few popular songs.

The committee having the program in hand has arranged for an interesting meeting and the executive, credit and sales manager and those engaged in business management, are urged to attend since the speakers will deliver messages of value to the electrical industry.

MILWAUKEE COMBINES FORCES TO PROMOTE BETTER LIGHTING.

Electrical Development Association of Wisconsin Establishes Bureau to Further This Movement and Disseminate Better Lighting Data.

The electrical interests of Milwaukee, among which are the Chandelier Club, the illuminating engineers, the Electrical Contractors and Dealers' Association, the Electrical Association of Milwaukee, the Electrical Manufacturers and Jobbers and the central station, have combined forces to promote better lighting in Milwaukee and throughout Wisconsin. The work is being carried on under the auspices of the Electrical Development Association of Wisconsin, successor to the Milwaukee Electric Show Association, a corporation chartered in 1915 under the laws of Wisconsin.

The officers of the Electrical Development Association of Wisconsin are as follows: President, R. M. Van Vleet; vice-president, Phil Polacheck; secretary, F. A. Coffin; treasurer, P. C. Burrill; directors, H. P. Andrae, R. M. Van Vleet, Phil Polacheck, F. A. Coffin, F. M. McInery, F. A. Vaughn and P. C. Burrill.

The association has already established a bureau in the First Wisconsin National Bank building, room 1324, where all questions relating to the wiring of buildings and electrical illumination will be answered free of charge by experienced lighting experts. The association does not take contracts nor sell fixtures, but part of its free service consists in furnishing approximate estimates on both.

The main purposes of the association, however, are the dissemination of up-to-the-minute information on better lighting among those engaged in the electrical business, informing the public through every effective agency of the value of better lighting in the home, in the office, the store and the factory and finally backing up this publicity by means of actual demonstrations. The financial, physical, moral and artistic advantages of better lighting will be explained and emphasis will be placed on the fact that better lighting is easily within the financial reach of all who are able to enjoy even the moderate comforts and conveniences of life.

The publicity is in charge of a publicity com-

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mittee, the members of which are F. A. Coffin, J. C. Schmidtbauer, and Arthur Polacheck. Charles L. Benjamin of Chicago and Milwaukee has been appointed director of publicity.

MASSACHUSETTS ASSOCIATION TO MEET IN SPRINGFIELD.

On Jan. 5 the Massachusetts State Association of Electrical Contractors and Dealers will hold its annual meeting and banquet at the Hotel Kimball, Springfield, Mass. The business meeting will take place at 2 p. m. in the grillroom of the Hotel Kimball, and at 6 p. m. the banquet will be held in the ballroom.

J. E. Wilson, secretary of the association, states: "We are very anxious that everyone who is in any way connected with the electrical industry attend our meeting. The doors are always open, and everyone is welcome. This invitation applies particularly to nonmembers of this association, and we hope if you are a nonmember, you will take advantage of this opportunity to attend our annual meeting."

STANDARDIZATION OF GLASSWARE HEELS NECESSARY.

Work Carried on by H. D'Olier, Jr., of the National Council of Lighting Fixture Manufacturers Will Be Beneficial to All Dealers.

Many dealers have experienced difficulty and have been put to considerable expense and trouble because of the lack of uniformity in sizes of glass fitters, or heels, as they are technically known, according to *Beardslee's Talks*. The heel is that portion of the glass shade or reflector which enters the holder or fitter. Often glass made by the same manufacturer and ordered with the same size heels or fitters varies to such an extent that fixture manufacturers have found it necessary to make special holders to meet the requirements. Consequently, when this special holder has been put in service and one of the pieces of glassware has become broken, it is often difficult to make other glassware fit the holder. Every dealer probably knows the annoyance of such an experience.

To overcome the difficulty, the Standardization Committee of the National Council of Lighting Fixture Manufacturers has engaged H. D'Olier, Jr., to do research work in an effort to determine the minimum and maximum allowance for the several dimensions of the heels on blown glassware. These are known as the 2.25, 3.25, 4, 5, 6 and 8-in. sizes. A gage has been devised which permits the checking of four measurements at one time and, if this standard is adopted by all manufacturers, it will permit the fixture manufacturer to establish a standard holder for each size of glassware and to take the holder screws in the proper position. A minimum inside diameter will enable the dealer to tell what size lamp can be used with any piece of glassware and will overcome the difficulty he has sometimes experienced when he found it impossible to use the lamp he had previously selected.

There is great need for standardization in the fixture industry. This work, so far completed, has been the starting point and it is hoped the next step taken will be the standardization of the sizes of screws and screw threads. Dealers who have questioned the value of the National Council to them will find their answer in such work as Mr. D'Olier has done. As soon as the benefits of such work are appreciated, every dealer will lend his whole-heated support to the National Council of Lighting Fixture Manufacturers.

OREGON ELECTRICAL CONTRACTORS ENTERTAIN ARCHITECTS.

Presentation of Lighting Effect Display Among Features of Banquet Tendered Oregon Architects by Portland Electrical Interests.

The Portland district members of the Oregon Association of Electrical Contractors and Dealers entertained the members of the Oregon Chapter of the American Institute of Architects at a banquet at the Portland Chamber of Commerce on the evening of Nov. 30. Close to 200 members of the two organizations were in attendance. Included, however, were a number of electrical jobbers, building contractors and power-company engineers.

J. H. Sroufe, president of the State Association of Electrical Contractors and Dealers, gave a brief review of the growth of that organization and the means by which the existing high degree of co-operation was attained. All branches of the electrical industry had been brought into coordination, one of the results being the organization of the Northwest Electric Service League, which is now functioning satisfactorily under the leadership of Stephen I. Miller, manager. Mr. Sroufe outlined briefly the educational work being carried on by means of motion-picture displays, industrial lighting exhibits and the establishment of electrically equipped homes. He emphasized the fact the public must be reached through the electrical dealer.

Stephen I. Miller, dean of the College of Business Administration, University of Washington, and manager of the Northwest Electric Service League, gave an interesting address, reviewing business conditions, analyzing the situation with reference to the outlook for 1922, which he considered bright. The speaker dealt with the interdependence of industries, competition, the adjustment of problems affecting capital and labor. The fact that vast sums of money have been invested in non-taxable securities was referred to as one of the causes of retarding building operations and railroad extensions. His discussion of shipping and foreign trade was analytical and broad in scope, as was also that pertaining to cash reserves and credits.

W. G. Purcell, president of the Oregon Chapter of the American Institute of Architects, spoke in behalf of that organization, expressing the

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readiness of architects to co-operate with the electrical contractors and dealers. After a few remarks by O. B. Coldwell, vice-president of the Portland Railway, Light & Power Co., Frank Branch Riley, industrial and scenic lecturer, gave one of his characteristic addresses.

The closing feature was the presentation of a lighting effect display by F. H. Murphy, illuminating engineer for the Portland Railway, Light & Power Co. Many of the lighting effects demonstrated are applicable to the show window, the home, florist shops and other places. There was brought into play the direct, indirect and semi-indirect lighting, with fixtures for the blending of colors to produce the various lighting effects. These included the several tints and hues to meet occasions, including the varying shades of red, yellow, blue, violet and white. The effects were brought out by table lamp, floor lamp, both direct and indirect, and the fireplace, with spotlights playing upon flowers. While all the varying effects were brought out with changing settings, the demonstration was in no respect an exhibit of any type of fixtures. The displays were made doubly interesting by Mr. Murphy's brief lecture on the subject.

RURAL POWER DISTRIBUTION WILL BE DISCUSSED.

The annual convention of the Association of Municipal Electrical Utilities of Ontario will be held in Toronto, Canada, Jan. 26-27, at which time the following papers are scheduled to be presented: "Further Developments in Rural Power Distribution," "The Effect of Underloaded Transformers on System Power-Factor," "The Measurement of Kilovolt Amperes for Power Billing," and "The Development of the St. Lawrence River."

SUPER-POWER SYSTEM DISCUSSED BY ENGINEERS.

The 246th meeting of the Schenectady (N. Y.) section of the American Institute of Electrical Engineers, held Dec. 2, was featured with an address on "A Super-Power System" by W. S. Murray, consulting engineer, New York City, and a director of the Super-Power Survey. Realizing the great waste and inefficiency of the present system of isolated electric power plants, the Government appointed a committee of engineers to study the power problems of the northern Atlantic seaboard. Mr. Murray was placed in charge of the survey and his comments on the subject proved most interesting to the members attending the Schenectady meeting.

ELECTRIC VEHICLE PEOPLE HOLD TRUCKING CONFERENCE.

The first of a series of conferences on trucking problems in New York was held Dec. 2 when the local electric vehicle men got together at a meeting called by the New York Edison Co., at the Edison Auditorium, 44 West 27th street. Among the speakers were James H. McGraw, president of The New York Electrical League, who spoke on "Looking Forward to the Future of Electric Trucks"; H. S. Baldwin, General Electric Co., on "The Field, Application and Economy of the Electric Truck," and C. G. Lambert, general manager of the Westcott Express Co., on "Trucks and Trunks."

This series of meetings will continue through the winter. Among the subjects announced for future discussion are "Winter Trucking," "Retail Store Deliveries," and the "Handling of Mail in New York." Advertising, garage practices and tire problems will also be considered.

GENERAL ELECTRIC INTERESTS GET SPANISH CONTRACT.

One of the largest railway electrification contracts secured by Americans in Europe was announced at Schenectady, N. Y., Dec. 1, by the International General Electric Co., which has been awarded an order involving more than $1,000,000 for the electrification of 40 mi. of the Spanish northern railway. The contract is for a 3000-volt d-c. system, awarded to the International General Electric Co. and its Spanish affiliation, the Sociedad Iberica de Constructiones Electridas of Madrid. It consists of six 78-metric ton, 6-motor locomotives, two complete substations, each comprising two 3000-kw., 3-unit motor generator sets, transformers, switch gear and necessary line material.

NEW ORLEANS GROUP MEETINGS OF N. E. L. A. COMMITTEES.

A. Jackson Marshall, committee secretary, Commercial National Section of the National Electric Light Association, has sent out from National headquarters, 29 West 39th street, New York City, to the members of the section's executive committee the following information regarding New Orleans group meetings to be held Jan. 18-20:

At the direction of R. H. Tillman of the Consolidated Gas, Electric & Power Co. of Baltimore and chairman, Commercial National Section, National Electric Light Association, a meeting of the section's executive committee is called for Jan. 20, at 10 a. m., at the Grunewald hotel, New Orleans, La. This meeting will be preceded on Jan. 18 and 19, also at the Grunewald hotel, by meetings of the section's bureaus and committees, as per following schedule:

Advertising and Publicity Service Bureau, 10 a. m. Jan. 19; Electric Vehicle Bureau, 2 p. m. Jan. 18; Merchandise Sales Bureau, 10 a. m. Jan. 18; Power Sales Bureau, 2 p. m. Jan. 18; Commercial Service and Relations with Customers Committee, 2 p. m. Jan. 19; Education Committee, 10 a. m. Jan. 19; Electrical Salesman's Handbook Committee, 2 p. m. Jan. 19; Electrically Equipped Furniture Committee, 2 p. m. Jan. 19, and Section's Executive Committee, 10 a. m. Jan. 20.

These meetings have been arranged in co-operation with W. E. Clement, of the New Orleans Railway & Light Co., and chairman, Commercial Section, Southwestern Geographic Division, National Electric Light Association, who, with Col. R. S. Stearns, past president, National Association of Electrical Contractors and Dealers, and Frank H. Ames, has been appointed as a committee by the New Orleans Electrical League to assist in making these meetings a success.

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Mr. Clement advises that arrangements have been made for meetings of the Electrical Contractors and Dealers Association of Mississippi and Louisiana, and the jobbers associations, and the commercial electrical men of the Southwestern Division, as well as the South generally, have been invited to meet with us in January.

Rawson Collier, of the Georgia Railway & Power Co., Atlanta, Ga., is arranging for an exhibition of live-line (high-tension) work—the changing of insulators, without interruption to service—for the members of the National Wiring Committee, of which R. S. Hale, The Edison Electric Illuminating Co. of Boston, is chairman, which committee will also meet at the Grunewald hotel, Jan. 17, and Mr. Collier is desirous of having members of the section's bureaus and committees attending the New Orleans meetings stop off at Atlanta for the "live-line exhibition" and other courtesies, which Mr. Collier would like to extend.

WESTINGHOUSE RECEIVES ANOTHER ORDER FROM JAPAN.

The Westinghouse Electric International Co. announces that it has received from its Japanese agent, Takata & Co., an order from the Daido Denrioku K. K. (the Daido Electric Power Company of Japan), for electrical apparatus for two large hydroelectric plants. The total value of this order is about $2,000,000. These hydroelectric plants are to form a part of a superpower system for the Tokio district, similar to that now under construction for the area between Boston and Washington. The current is to be transmitted at 154,000 volts.

This is the second large order that the Westinghouse Electric International Co. has received from Japan within the last few weeks. The first order was for switching equipment for the Tokio Electric Co. and amounted to about $1,000,000.

INSPECTORS TO DISCUSS USES OF ARMORED CONDUCTORS.

Identification of Grounded Circuit Wires and Unity of Electrical Industry Among Subjects to Be Considered by Western Association.

The tentative program prepared for the 17th annual meeting of the Western Association of Electrical Inspectors, to be held at the Hotel Sherman, Chicago, Jan. 17-19, includes some interesting addresses on the following subjects: "Installation and Uses of Radio Equipment," "Reduction of Life and Fire Hazard at Meter Installations," "Safety First," etc. An outline of the program follows:

Tuesday, Jan. 17, 10 *a. m.*—Address of welcome by William Hale Thompson, mayor; reply to address of welcome by O. M. Frykman, first vice-president, Minneapolis, Minn.; roll call; address by President James H. Fenton; report of executive committee; report of secretary; report of treasurer; appointment of nominating committee; addresses on "Army Signaling" by Major J. O. Mauborgne, signal officer, Sixth Army Corps; "Installation and Uses of Radio Equipment," (illustrated) by Laurens E. Whittemore, physicist, Bureau of Standards, Washington, D. C.

Tuesday, Jan. 17. 2 *p. m.*—Addresses on "Reduction of Life and Fire Hazard at Meter Installations," (illustrated) by Joseph C. Langdell, meter engineer, Hodenpyl-Hardy & Co., Jackson, Mich.; "Safety First" (including practical demonstration of prone pressure method of resusitation from electric shock), by H. J. Burton, electrical engineer, Consumers Power Co., Jackson, Mich.; "The Uses of Armored Conductors" by J. M. Collins, secretary, Electrical Contractors Association of the City of Chicago; "The Power Requirements of a Physician Using Electricity for Therapeutical Purposes" by Dr. J. Walter Wigelsworth, Chicago; "Identification of Grounded Circuit Wires," by A. R. Small, vice-president, Underwriters' Laboratories, Chicago; "The Unity of the Electrical Industry" as a general subject, (a) The Electrical Manufacturer's Co-operation, by a representative of the Associated Manufacturers of Electrical Supplies; (b) Electrical Contractor and Dealer's Co-operation, by a representative of the National Association of Electrical Contractors and Dealers; (c) The Central Station's Co-operation, by a representative of the National Electric Light Association.

Wednesday, Jan. 18, 10 *a. m.*—Discussion of inspectors' problems. Members are requested to present these to the secretary in writing as far in advance of the meeting as possible.

Wednesday, Jan. 18, 2 *p. m.*—Tests of electrical fittings and material, Underwriters' Laboratories, 207 East Ohio street.

Thursday, Jan. 19, 10 *a. m.*—Discussion of inspectors' problems; reports of special committees, new business, report of nominating committee; election of officers.

Friday, Jan. 20.—Inspection tours.

RADIO ENGINEERS HOLD MEETING.

A paper on "Recording High Speed Signals in Radio Telegraphy," by Julius Weinberger, research department, Radio Corporation of America, was the feature of the meeting of the Institute of Radio Engineers held in the Engineering Societies building, New York City, Dec. 7. A commercial system of high speed recording was described and demonstrated, both by the actual apparatus and by motion pictures.

COMING CONVENTIONS.

New York Electrical Credit Association. Twenty-sixth annual meeting, Building Trades Club, 30 West 33rd street, New York City, Dec. 14. Secretary, W. J. Kreger, 1035 Marbridge building, 47 West 34th street, New York City.

American Building Exposition, new Cleveland Auditorium, Cleveland, Jan. 4-14. Assistant manager, R. G. Collier, 1305 Schofield building, Cleveland.

Massachusetts State Association of Electrical Contractors and Dealers. Annual meeting, Springfield, Mass., Jan. 5. Headquarters, Hotel Kimball. Secretary, J. E. Wilson, 263 Summer street, Boston.

Western Association of Electrical Inspectors. Annual convention, Chicago, Jan. 17-19. Headquarters, Hotel Sherman. Secretary, William S. Boyd, 175 West Jackson boulevard, Chicago.

Association of Municipal Electrical Utilities of Ontario. Annual convention, Toronto, Canada, Jan. 26-27. Secretary, S. R. A. Clement, 190 University avenue, Toronto, Ont.

Lighting Fixture Dealers' Society of America. Annual convention, Milwaukee, Jan. 30-Feb. 2. Secretary, J. L. Wolf, Builders' Exchange, Cleveland.

National Council of Lighting Fixture Manufacturers. Annual convention and Lighting Fixture Market, Auditorium, Milwaukee, Jan. 30-Feb. 4. Secretary, Charles H. Hofrichter, 231 Gordon Square building, Cleveland.

American Institute of Electrical Engineers. Midwinter convention, Engineering Societies building, New York City, Feb. 15-17. Secretary, F. L. Hutchinson, 33 West 39th street, New York City.

Home Beautiful Exposition, Mechanics building, Boston, April 15-29. Manager, Chester I. Campbell, 5 Park square, Boston.

Milwaukee is planning a great week of activity for the entire Lighting Industry —The dates are from January 30 to February 4, 1922—ARE YOU GOING?

THE FIXTURE MARKET

Items of Interest to Manufacturers, Jobbers and Dealers in Electrical Fixtures, Including Problems of Manufacture and Distribution

BRIGHT PROSPECTS IN SIGHT FOR COMING YEAR.

"Fixture Market" Developing Into a Real Force in Lighting Field as Result of Progressive Policy and Hard Work.

P. A. Powers, advertising manager of the Benjamin Electric Manufacturing Co., believes that the coming year will see great improvements in the lighting fixture field. The following comments are taken from a recent letter to ELECTRICAL REVIEW in which Mr. Powers expressed his confidence in the prospects for the coming year:

"We feel that next year will witness the beginning of an up-turn in the market for lighting fixtures of the character manufactured by the Benjamin company; that is, fixtures for industrial lighting purposes. One of the forces which will tend to accelerate the sale of lighting equipment will undoubtedly be the 'Market' to be held in Milwaukee at the end of January, 1922.

"This company has witnessed with a great deal of interest the expansion in the Lighting Fixture Market from a purely ornamental lighting fixture exhibition to a real fixture market where sales are made and where lighting salesmen are made out of contractors and dealers.

"We are also interested in observing that the fixture market is expanding so as to take in that important branch known as "industrial illumination," and that show-case, window and commercial lighting are receiving their share of attention.

"Using the term 'fixture market' in a broader sense than just mentioned, and having it applied to the market for lighting equipment over the entire country, it is interesting to note that there is an undoubted increase in inquiries on the part of business men, factory managers and others on such subjects as commercial and industrial illumination. Managers of stores are studying the effects of correct illumination upon their public and factory managers are learning that correct illumination has a direct bearing on the costs of operation. This company will undoubtedly bring forward at an early date new material which will have its part in stimulating the sales of lighting material all the way 'round."

DOES IT PAY TO TAKE ADVANTAGE OF A CUSTOMER?

Narrative of an Instance Where It Is Evident That It Did Not Pay to Make False Representation of Facts.

The following incident, told by G. L. Wolf in his Secretary's Letter to the fixture dealers, is well worth considering. While the same circumstance may not be repeated, the same principle is sure to find application every day in every busy fixture dealer's shop in the country:

"While visiting in one of the larger cities last week I was in the store of one of our dealer members who carries a fairly high-grade line of goods. A customer from a distant small town was being waited on by the department manager and, after placing an order for five fixtures totaling about $400, made this remark: 'I was over to such and such a firm and after looking at their goods asked if there was not another firm handling a similar line of goods that I could see, so as to make comparisons. The man waiting on me, after a minute's thought, said "No, there is no firm in this city that handles goods of the character that we carry."'

"Contrast this attitude with that shown in a recent advertisement by the Peerless Motor Car Co. This advertisement was in the daily papers of a large city that was having an 'inclosed car week.' The portion of the advertisement in which we were interested read as follows: 'Peerless automobiles will be at your service to deliver you to any of the other automobile salesrooms after you have completed your inspection of Peerless cars. Open in the evening until ten o'clock during 'Inclosed Car Week.' A little of the spirit shown by this automobile firm would certainly improve the fixture business to a great extent."

FRIENDSHIP OF THE ARCHITECT AS AN ASSET.

Better Equipment Used and a More Satisfied Customer Made as Result of Co-operation Between the Architect and Fixture Man.

BY DE QUETTEVILLE WHITTLE.

A good architect is more than just a good designer of buildings. He must have the vision, the imagination and the temperament of the artist and the designer. He must be well schooled in the various periods of art and decoration and be able to draw from a vast storehouse of knowledge in these professions. But in addition to these attributes of the idealist he must be intensely practical. He must be familiar with hundreds of kinds of raw materials which are at his command and which he may use, and practically thousands of manufactured articles used in the building and equipping of modern structures. Hence, in order that his design shall be carried out in its entirety and that he, as his client's agent, shall create their joint conception of the proposed building his supervision must extend beyond the shell of the edifice.

The selection of lighting fixtures is as much a part of the architect's profession as the selection of the building stone, plumbing and lumber. He need not do the actual designing, because he is not interested in the intricacies of construction. This

should be left to the contractor, who is either a manufacturer or handles fixtures made by a responsible firm. It is obvious that the control by the architect of design and style in lighting fixtures carries with it the control of the appropriation set apart for their purchase.

To install lighting equipment that is appropriate to the surroundings and bears a rational relation in workmanship and material to the rest of the building is naturally more vital to the architect than the question of price. The owner if left to himself is apt to spend too freely during the early stages of designing or construction and by the time lighting equipment is reached his purse becomes flat and price outweighs design. Add to this the timidity of the salesman, who is afraid to lose an order, and the result is a cheap installation unsatisfactory to everyone concerned.

The salesman or the dealer should have sold better equipment, the manufacturer should have had an opportunity for finer work, and the owner should have had better fixtures. Making a friend of and dealing with the architect corrects this state of affairs, for he can balance his appropriations in such a way that no part of the structure suffers at the expense of another, and his ability is an assurance that the pieces selected are in harmony with the architectural details, decorations and furnishings. His experience in construction has taught him to determine accurately how much can be expended for lighting fixtures in proportion to the cost of the building and furnishings. Very often if he is given a free hand he will apportion more than an arbitrary 1% for the lighting equipment. That too frequently the architect has not been consulted can be attested by the many $1000 rugs lighted by $15 chandeliers.

Cultivate the friendship of and work with the architect, for he is a good friend to every reliable contractor and as a constant and highly educated buyer of lighting equipment he is an important factor toward the betterment of the fixture business as a whole, and your business in particular.

MUCH INTEREST BEING DISPLAYED IN MILWAUKEE "MARKET."

Many Manufacturers Planning to Visit Wisconsin City to Make Displays and Study Prospects of Future Business.

N. W. Belmuth, of Shapiro & Aronson, Inc., New York City, writes to ELECTRICAL REVIEW expressing much enthusiasm for the coming year and for the stimulus to business which he anticipates to result from the Milwaukee Fixture Market. The accompanying illustration shows an interior of one of the display rooms of the Chicago Lighting Fixture Co., representatives in the Chicago district of Shapiro & Aronson, Inc. J. Salzman, of the Chicago Lighting Fixture Co., says that he now has in stock enough equipment to fill without delay any demands for S & A fixtures that may be made in his territory, which includes Illinois, Indiana, Michigan, Wisconsin and neighboring districts.

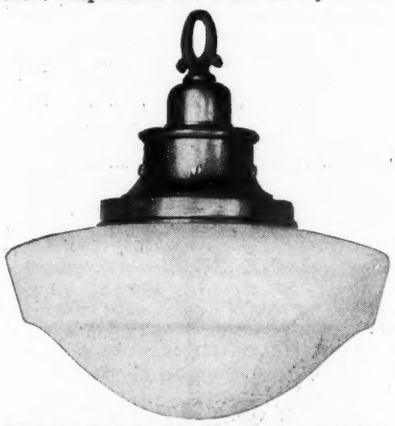
View in One of the Display Rooms of the Chicago Lighting Fixture Co.

APPLIANCES and DEVELOPMENTS

New, Improved or Interesting Electrical and Mechanical Apparatus and Devices, and Applications of Equipment and Methods in Practice

A Safety Holder with Resilient Metal Fingers.

The accompanying illustrations show an interesting development in safety holders which it is claimed eliminates the danger and expense of falling glassware. The steady increase in the size of fixture globes due to the large dimensions of modern high-wattage lamps has caused a growing uneasiness among those responsible for state safety codes.



Cochran Safety Holder, Showing Elimination of Projecting Holder-Screws.

It has been realized that the usual means of attaching these heavy globes to their fixtures by means of holding screws is no longer always adequate for safety, especially in schools and places of public assembly where the lighting units are often suspended at a considerable height above the floor.

The Cochran safety holder illustrated, which is manufactured by the Art Metal Manufacturing Co., of Cleveland, meets the difficulty in a novel and ingenious manner. Instead of the usual holding screws the means of support are resilient metal fingers. These are slipped

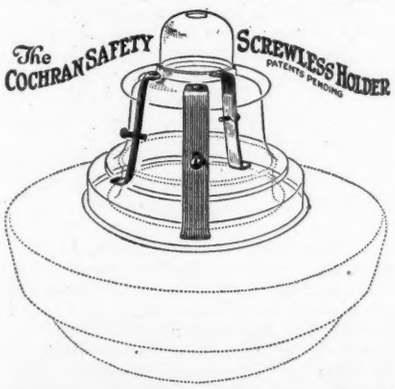


Diagram of Cochran Safety Holder Showing Metal Fingers, Etc.

into the globe and pushed outwards by means of the adjusting screws until the bent ends support the weight of the globe. In this way the amount of tension on the adjusting screws may be varied within wide limits without decreasing the efficiency of the grip on the globe, and because of the resilience of the fingers it is impossible for the glassware to be broken through unequal tension, heat expansion, or vibration. Furthermore, the pressure of the upper portion of the fingers against their respective adjusting screws acts as a lock-nut and prevents them from working loose. The elimination of projecting screws from the holder greatly adds to its attractiveness.

Attractive Adjustable Portable Electric Lamp.

The leader of the "Esrobert" line of portables made by the S. Robert Schwartz & Bro., 729 Broadway, New York City, is the "Esrobert" portable lamp No. 309, which is an adjustable type with a heavy cast metal base 8.25

"Esrobert" Portable Lamp No. 309.

ins. long and 5.75 ins. wide, felted on the bottom and equipped with a special 13-in. brass phlexarm stem, giving a maximum height of 24.5 ins.

The 7-in. parabolic brass shade is frosted aluminum on the inside while the wiring equipment consists of an association key socket, 10 ft. of new code parallel mercerized cord and a two-piece association attachment plug. The lamp is finished in either verdgold, japgold or barbedeen and packed in individual corrugated cartons.

Portable Electric Lamp with Eye Protecting Shade.

Electricity is conceded to be the best artificial light and if it is directed just where wanted without affecting the eyes, perfect comfort and highest efficiency is obtained. To attain these results as near as possible the Beer Sales Co., 2 Hudson street, New York City, has designed and manufactured the Lyhne lamp.

This device is a portable lamp that may be adjusted for use on desk, table or piano and is fitted with a perfect parabolic reflector which gives a clean cut light on the exact spot desired without "ray shadows," while the revolving adjustable opaque shade confines the light to the space to be illuminated, protecting the eyes from all strain and glare. This scientific diffusion of the light, it is claimed, saves 90% of the eye strain.

The lamp is made entirely of metal and has no glass to break. The standard may be extended various lengths

Lyhne Portable Electric Lamp.

while the shade may be lowered in front of the reflector or revolved to either side. Four styles are marketed and the standard finishes are brush brass, full nickel, oxodized copper and statuary bronze. There is a model for the office, home and a bracket lamp with a telescoping swinging double jointed arm, universally adjustable and attachable to the top or side of any desk, table or wall and therefore effective for general office use. The fourth model is a floor lamp adjustable from 36 to 65 ins. in height and equipped with the exclusive features of the Lyhne portable.

Macbeth Glass for Commercial and Home Lighting.

The Macbeth-Evans Glass Co., Pittsburgh, has issued catalog No. 112 on Macbeth lighting glass, which contains illustrations and description of Macbeth "Decora," Macbeth "Thebian," Macbeth "Alba," Macbeth "Monax" and miscellaneous lighting glass. This is a handsome 64-page catalog, size 9 by 6 ins., and many of the illustrations are printed in colors, which greatly enhances the effect produced by the Macbeth lighting glass. In the front part of the catalog, under the heading "Macbeth Lighting Glass" appears the following:

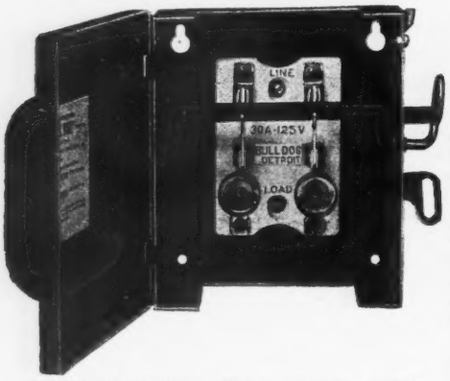
"There is a steadily growing appreciation of the value of good illumination. For a long time its importance was not generally realized, due chiefly to the fact that it is so subtle. People avoid a store that is poorly lighted. On the other hand, they will stay longer in a store which is well lighted, and conse-

quently buy more. It is because of this fact that progressive stores are equipped with the most modern lighting systems. In offices as well as in factories the effect of good illumination is to increase the efficiency of employes—they work better and with less strain when they have just the kind and quantity of light suited to their work.

"Generally speaking, while appearance is important in commercial lighting, it is considered secondary to efficiency. This is contrary to the general practice in home lighting. Here the desire to secure artistic effects dominates. Consequently, efficiency is made secondary. In any event, to secure efficient or decorative lighting, or a combination of both, the correct glassware must be used. The Macbeth lighting glass shown in this book includes a wide variety of shades, bowls and globes, and meets the complicated problems in commercial and home lighting."

New Line of "Bulldog" Safety Type Switches.

A new complete line of "Bulldog" safety type switches which embody several new and practical features, is to be placed on the market by the Mutual Electric & Machine Co., Detroit. All



"Bulldog" Safety Type Switch, with Cabinet Open.

parts of the new switches are standardized, and removable and interchangeable end-plates are a prominent feature. An unusually large number of knock-outs, well-placed, meet any wiring condition.

"Mutualite," the latest development in insulating material, makes it possible to build these switches so that the switch blades are actually reinforced. It is stated that "Mutualite" is an exclusive "Bulldog" feature. The switch jaws are of heavy "Bulldog" type A built-up

"Bulldog" Safety Type Switch, with Cabinet Closed.

construction. The strong blades and heavy switch jaws give a maximum contact. Quick break and positive make is provided for all switches over 30 amperes. The switch cannot be closed with the door open except by an experienced maintenance man. The door may be locked closed and the switch locked open with one or more locks. To inspect the switch without shutting down the machinery the door can be opened with a special key.

The operating handle and switch are of unit construction and may be removed and replaced without taking the box off the wall. The steel cabinet is exceptionally roomy, allowing large wiring space. It is inconspicuous when mounted on the wall and its high luster black enamel, of a quality usually found in adding machines and fine equipment, balances well with the other fittings of the plant.

The manufacturer states that deliveries are now being made on the 30 ampere entrance type switch. This type has a porcelain base and differs slightly from the general construction of the larger size switches. The "Bulldog" line is approved by the Board of Fire Underwriters, according to the manufacturer.

Leaflet on Torrington Electric Vacuum Cleaner.

Nineteen days of hard labor a year—that is the sentence pronounced on the housewife who does not have an electric vacuum cleaner. In 10 yrs. this amounts to nearly 7 mo. of distasteful drudgery, all of which is saved the woman who owns one. A new leaflet issued by the Torrington Co., Torrington, Conn., for popular distribution describing the Torrington electric "vac" brings out this point, and tells in her own words what one housewife's experience was in using the cleaner for the first time. "Just as essential for the home as a lawn mower or water faucets," was the verdict of this home-maker on the cleaner.

Fixture Switch Made for Wall Brackets, Canopies, Etc.

The McGill Manufacturing Co., Valparaiso, Ind., manufacturer of the "Loxon" and "Levolier" line of electrical specialties, has recently issued fold-

"Levolier" Fixture Switch.

ers illustrating and describing the "Levolier" heavy duty pull socket and the "Levolier" fixture switch. In connection to the pull socket the company gives the following data: It carries the extra load of heating appliances safely; it saves time in assembling as the lever is attached to the interior, no loose chain guide to adjust; the lever and chain may be removed and replaced without disturbing the shell; should the chain break the lever remains to operate the mechanism. The socket, therefore, is never out of service; it is approved by the National Board of Fire Underwriters and guaranteed by the manufacturer.

The "Levolier" fixture switch, shown in the accompanying illustration, is designed for canopies, ceiling pans, wall brackets, fixture bodies, etc. The manufacturer states that it is a very small switch with a big rating and is built to withstand abuse. It is equipped with a 2-in. chain, connector and 10 ft. of cord with ball. The nipple fits into a 5/8-in. hole in the canopy or ceiling pan and is held securely by a nut. The lever pulls in any direction, with a short, easy pull.

Electrical Appliance for Shaping Hats, Ribbon, Etc.

A new appliance known as the electric "Tommy Iron" has recently been placed on the market by the Tommy Iron Manufacturing Co., 1900 Olive street, St. Louis. Milliners, manufacturers, jobbers and similar trades are using this device in their workrooms for hat construction and freshening up old stock. Dressmakers, housewives and hat manufacturers are also using it. The appliance can be used to shape folds and

Electric "Tommy Iron."

give the correct curves to bias flanges and brim coverings; also for shaping ribbon and bows without removing the material, and duvetine and velvet seams can be pressed without the danger of marring, it is stated. Another special feature of the "Tommy Iron" is the mirroring of beautiful stencil designs on velvet, and laces, crepe, tulle, organdy and other filmy fabrics can be worked satisfactorily with this appliance.

The electric "Tommy Iron," shown in the accompanying illustration, is furnished complete with both attachments for upright and flat surface ironing; 6-ft. extension cord, and wooden base and clamp for upright work. It is nickel-plated, 12 ins. in length, weighs 2.5 lbs., and is packed neatly in an individual box.

Universal Crane Co., Elyria, O., announces that Geo. L. Sawyer, former sales manager of material handling machinery for Barber-Greene Co. of Aurora, Ill., has been appointed to represent it in the New York field in the sale of Universal cranes. His offices are at Allied Machinery Center, 141 Center street, New York City. Keen interest in the Universal crane has been shown throughout the territory due to the crane's adaptability to so many types of mountings and its great flexibility and economy in almost all material handling fields.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

London E. Klein, Inc., New York City, operating an electrical contracting business, has leased property at 228 West 29th street, for a new establishment.

Mutual Lamp Manufacturing Co., New York City, heretofore occupying a portion of the building at Houston and Crosby streets, has acquired the entire factory for expansion.

Westinghouse Air Brake Co., Wilmerding, Pa., has resumed full operations at its local plant, giving employment to about 4500 men. The works have been operating on a 60% capacity basis.

Crouse-Hinds Co., Syracuse, N. Y., has issued catalog No. 1000 and supplementary bulletins Nos. 1000A to 1000J inclusive, covering its various types of condulets, covers, accessories and condulettos.

Carter Electric Co., Kokomo, Ind., has awarded a contract to Thomas Heckman, 810 South Webster avenue, for a 2-story and basement plant on South Washington street, to manufacture electrical specialties.

Blaw-Knox Co., Pittsburgh, manufacturer of steel products, has announced that its New York office will, on Dec. 15, be moved from the City Investing building to the Carbide & Carbon building, 30 East 42d street.

Bullock Manufacturing Co., New York City, manufacturer of lighting fixtures and equipment, has removed its plant from 408 West 13th street to 356 West 40th street, where an entire factory will be occupied. Former production will be increased.

S. Robert Schwartz & Bros., 729 Broadway, New York City, have just issued catalog No. 19, describing and illustrating the variety of styles and finishes in desk and floor "Esrobert" portables which can be obtained from stock. This catalog is attractive and well prepared and of interest and value to the electrical fixture dealer.

St. Louis Brass Manufacturing Co., St. Louis, has recently issued catalog B. C. 11 covering some of the styles of residence lighting fixtures manufactured by the company. The catalog consists of 48 pages, size 10.5 by 8 ins. The company designs and manufactures every type of lighting fixture, and maintains a separate department for each stage of the manufacturing process.

Robbins & Myers Co., Springfield, O., manufacturer of electric motors, generators and fans, held its annual sales convention Nov. 25-29 at the Springfield headquarters. Representatives from all domestic branches, the export office and the Robbins & Myers Co. of Canada were in attendance. Sales and advertising plans for 1922 were explained and discussed. Considerable time was also spent with the engineering department, where recent improvements in design and construction were explained. A decided spirit of optimism was prevalent at this meeting. Nearly every delegate reported business on the upturn in his territory and expressed the belief that a marked improvement would soon be shown.

Fancleve Specialty Co., Boston, has issued a bulletin illustrating and describing its switch boxes for exposed work, tandem boxes for exposed work, semi-flush switch boxes for National metal molding, adapters, outlets for moldings, outlets for concealed work, heavy outlets for exposed conduits or cables, molding boxes, etc.

Kuhlman Electric Co., Bay City, Mich., transformer manufacturer, has issued an 8-page illustrated pamphlet, 8.5 by 11 ins., designated as bulletin No. 110 and entitled "Series Multiple Street Lighting." This describes in an interesting way the Kuhlman street-lighting transformers and reproduces a typical scene showing the results of using series multiple illumination.

Cook-Art Illuminating Products Corp., 225 Fifth avenue, New York City, has now on display at its new showroom, 115 East 26th street, New York City, a line of table and floor lamps made up in crystal, satin, leaded and parchment effects designed under the guidance of the well known artist, Henri Raphael Cook. Catalog No. 9 describing the company's products will shortly be issued.

The Okonite Co., Passaic, N. J., manufacturer of Okonite insulated wires and cables, Okonite and Manson tape, "Okoloom," etc., has opened a branch office in room 1513 Candler building, Atlanta, Ga., with E. A. Thornwell as Southeastern sales representative and John L. Phillips, manager. Their territory will be North and South Carolina, Georgia, Alabama, Florida, Tennessee and the city of New Orleans, La.

American Jobbers Supply Co., Woolworth building, New York City, has announced the acquisition of T. Charles Brown, formerly with the Electric Service Supply Co., and the National Conduit & Cable Co., who will specialize in the distribution of "Pinco" insulators made by the Porcelain Insulator Corp., Lima, N. Y. The American Jobbers Supply Co. has the exclusive sale of this wet process porcelain insulator in the East and Mr. Brown has been engaged in selling such material since 1910.

Henry D. Sears, 80 Boylston street, Boston, general sales agent for Weber dependable wiring devices, has issued a handsome 2-color 104-page catalog, profusely illustrated and presenting complete information on the entire line. The first portion is devoted to data on Weber, Universal and Royal sockets, caps, bases; pull and key sockets, ordinary and high capacity; keyless and push sockets; key and pull wall switches; pull ceiling and fixture switches; key and pull candle switches; pull switches and rosettes. Then follows a section on Weber electrolier sockets and switches designed primarily for fixture use and description of Weber porcelain wiring devices. Weber weatherproof receptacles and porcelain mogul sockets are included, together with two pages of advance information for those who build, on "elexits"—places for lights. The catalog concludes with an extensive index and price list which not only shows every item manufactured, but gives conveniently the page reference, list price and sizes of standard package and carton.

Allis-Chalmers Manufacturing Co., Milwaukee, has issued bulletin No. 1119 on "Steam Turbine and Alternator Units," covering high-pressure condensing units of 1500 and 1800 r. p. m., for public utilities, municipal railways and lighting and all industrial activities.

Warren Steam Pump Co., Warren, Mass., is distributing 5 new bulletins on the following subjects: "Eclipse" valve gear for single pumps; duplex outside-packed plunger pumps, end and center-packed types; duplex automatic pumps and receivers, piston and plunger patterns; vertical duplex piston pumps for boiler feed or pressure service and tank or light service; single outside-packed plunger pumps, end and center-packed types. These bulletins are numbered 106 to 110 respectively.

Simon-Carves, Ltd., Manchester, England, has issued a booklet 9 by 11 in., 56 pages. This describes and illustrates the British Baum coal washing plant, giving sectional drawings and plans of the 150 ton per hr. illustration at the Penallta Colliery. Several full page photographic reproductions of installation are also given. Coal handling, crushing and storage plants, with illustrations of the units and of various installations are included. A list of installations and maps of the coalfields of England and Scotland conclude the booklet.

Chain Belt Co., Milwaukee, Wis., has opened offices at 735 Ellicott square, Buffalo, N. Y., and have announced the appointment of T. E. Cocker as district manager of that territory. Mr. Cocker will handle the Rex line, including chain, sprocket wheels, Rex traveling water screens, elevators and conveyors. For the past 5 years Mr. Cocker has been handling elevating and conveying equipment. He is a graduate of the Rensselaer Polytechnic Institute at Troy, N. Y., class of 1907, civil engineering. From 1907 to 1917 he was connected with the New York Central railroad at Buffalo, and at the time he left this company was assistant engineer.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

J. T. TRAVIS has opened electrical engineering offices in the Rialto building, Kansas City, Mo.

M. L. PYLE has resigned his position at Bridgeport, Ala., with the Public Light & Power Co. to enter the employ of the Kentucky Utilities Co.

CARL F. HOFSTETTER, formerly with the Wagner Electric Manufacturing Co. of St. Louis, is now located with the Mechanical Appliance Co., Milwaukee.

L. F. WOODRUFF has left the General Electric Co. to become an instructor in the electrical engineering department of the Massachusetts Institute of Technology.

WM. B. HAMBLIN CAHOON has left Lockwood, Greene & Co., New York City, and is now with Woodwell & Resler, of New York City, as electrical engineer.

JOSEPH A. ELIZI has become an instructor in the University of Colorado. He has been located with the Westinghouse Electric & Manufacturing Co. at East Pittsburgh, Pa.

B. B. BESSESEN, formerly sales engineer with the Manistee Iron Works, Seattle, Wash., has become an instructor in the electrical engineering department of the Oregon Agricultural College.

CHARLES P. TOWNSEND, formerly with the General Electric Co. in Atlanta, Ga., has accepted an appointment as superintendent of the Abbeville water and electric plant, Abbeville, S. C.

D. MCFARLAN MOORE has recently become a vice-president of the Illuminating Engineering Society. Mr. Moore has been well-known in electrical circles for a number of years, especially in connection with his vacuum-tube lighting system. He is at present manager of the Moore Light Department of the General Electric Co., at Harrison, N. J. He is a fellow of the American Institute of Electrical Engineers and has served in other technical bodies.

DR. ERNEST FOX NICHOLS, who upon the advice of physicians recently resigned as president of the Massachusetts Institute of Technology, is to return to Cleveland to resume the directorship of the Laboratory of Pure Science maintained by the National Lamp Works of General Electric Co., Nela Park, which position he left previous to his inauguration to the presidency of the Institute on June 8, 1921. Because of ill health Dr. Nichols never actively assumed his office. This has been a keen disappointment to Dr. Nichols' associates and many leaders interested in the management of educational institutions especially in the scientific field, for upon accepting the presidency he announced that he would atttempt to maintain a proper balance between pure science and applied science. In a letter to the executive committee of the corporation of the Massachusetts Institute of Technology, offering his resignation, Dr. Nichols said, "A sufficient time has now elapsed since the onset of a severe illness, which followed immediately upon my inauguration, to enable my physicians to estimate consequences. They assure me certain physical limitations, some of them probably permanent, have resulted. These, they agree, make it decidedly inadvisable for the Institute or for me that I should attempt to discharge the manifold duties of president. Indeed, they hold it would be

Dr. Ernest Fox Nichols.

especially unwise for me to assume the grave responsibilities, to attempt to withstand the inevitable stresses and strains of office, or to take on that share in the open discussion of matters of public interest and concern inseparable from the broader activities of educational leadership. In his work at Nela Park, Dr. Nichols' time will be more nearly at his personal disposal. Commenting on his return, Dr. E. P. Hyde, director of research at Nela Park, said, "In the judgment of Dr. Nichols' physicians the physical disqualifications for the exigencies of educational administration are such as need not restrict his activities in the simpler, untroubled, methodical life of scientific investigation to which he was bred." Dr. Nichols is widely known in the educational and scientific world. He has done much scientific research work with light. His calculation of the pressure of light upon the earth is accepted universally. Shortly before leaving Cleveland he perfected apparatus for measuring the heat of the stars. From 1909 to 1916 Dr. Nichols was president of Dartmouth College. He has held professorships at Colgate, Yale and Columbia universities and has studied at the Kansas Agricultural College, Cornell University, the University of Berlin, and Cambridge University.

FRANK E. OVERBEY has left the Cutler-Hammer Manufacturing Co., of New York City, to accept a position as assistant superintendent with the Bauer Electric Co., of Hartford, Conn.

GILBERT C. LAMB, formerly with the American Railways Co., Philadelphia, and General Electric Co., Schenectady, N. Y., has become associated with the engineering department of the Condit Electrical Manufacturing Co. of South Boston, Mass.

PROF. LOUIS C. MONIN, dean of the cultural studies of the Armour Institute of Technology, Chicago, has been granted a leave of absence until September, 1922. A large part of this time will be spent in European travel.

HOWARD H. ADAMS, who has been a cadet engineer with the United Improvement Co., Philadelphia, is now located with the Northern Indiana Gas & Electric Co., at Hammond, Ind., as assistant superintendent in the engineering department.

JAMES F. NEILD has become associated with the Toronto Transportation Commission, Toronto, Ont., in the capacity of electrical engineer. He was located until recently with the Toronto Railway Co., where he had been superintendent of substations for 8 yrs.

C. N. CHUBB, vice-president and general manager of the People's Light Co., Davenport, Ia., was the speaker at the November meeting of the Tri-Cities Engineers' Club. His topic was "The Conservation of Natural Resources with Respect to the Utility Business."

R. W. EVERSON, formerly manager of the merchandising department of the Westinghouse International Co., has left for Mexico City, where he has been assigned to the Mexican office of the Westinghouse Electric International Co. Mr. Everson has been connected with Westinghouse interests for the past 25 yrs. For several years he had charge of the export activities in the supply department and in 1906 he was transferred to the Chicago district office of the Westinghouse Electric & Manufacturing Co., where he specialized on syndicates. In 1919 he was made manager of the merchandising department of the International company.

OBITUARY.

FRANK H. BATES, Corry, Pa., vice-president of the Corry City & Union City Electric Co., and superintendent of the Unity City Electric Light Co., died last month as a result of an electric shock, caused by coming into accidental contact with a 2300-volt power line.

WALTER J. RICHARDS, chief engineer of the National Brake & Electric Co., Milwaukee, for 15 yrs., and widely known as an electrical authority, died recently after an illness of a year. He was 50 yrs. old. Mr. Richards was a graduate of the college of engineering, University of Wisconsin.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES.

Windsor. Conn.—Plans are being prepared for a 4-unit, 12,000-hp. hydroelectric plant for the Farmington River Power Co.

Brooklyn, N. Y.—Brooklyn Edison Co., 360 Pearl street, has awarded a contract to the General Contracting & Engineering Co., 29 Broadway, New York City, for foundation work for its proposed electric generating plant on property recently acquired at the foot of 66th street, estimated to cost $800,000.

Buffalo, N. Y.—National Lamp Works of the General Electric Co., Nela Park, Cleveland, O., has preliminary plans under way for erection of a power house at its local plant on East Ferry street, to cost about $100,000. It is proposed to commence erection early in the spring.

Buffalo, N. Y.—The city council has approved an ordinance requiring the electrification of all steam railroads entering the city by January 1, 1923. A number of railroads are affected by the new law, including the New York Central; Lehigh Valley; Delaware, Lackawanna & Western; Erie; Michigan Central and Wabash railroads.

Hornell, N. Y.—Electric motors and other industrial electrical equipment will be installed in the 1-story plant addition to be erected by the Erie Railroad Co., 50 Church street, New York City, at its Hornell shops, estimated to cost $100,000.

Long Island City, N. Y.—Considerable electrical equipment will be installed in the 4-story factory to be erected on Rawson street, near Queens boulevard, by the Ormant Realty Co., Inc., 19 Greene street, New York City, estimated to cost $165,000. Gronenberg & Leuchtag, 450 Fourth avenue, New York City, are architects.

Long Island City, N. Y.—Considerable electrical equipment will be installed in the 6-story, food product manufacturing plant to be constructed by the Richard Hellman Co., 501 Steinway avenue, on Jackson avenue, near Buckley street, estimated to cost $255,000. Plans have been completed.

New York, N. Y.—Electric Bond & Share Co., 71 Broadway, is perfecting arrangements for the purchase of a controlling interest in the American Cities Co., New Orleans, La., operating a number of public utility properties in such district, including the Houston (Tex.) Lighting & Power Co., New Orleans Railway & Light Co., and the Birmingham (Ala.) Railway, Light & Power Co. The purchasing company will increase its capitalization by $5,000,000.

New York, N. Y.—Electric motors and other electrical equipment, ice machinery, etc., will be installed in connection with extensions and improvements to be made by the Charles G. Hupfel Brewing Co., 229 East 38th street, at its ice manufacturing plant, estimated to cost $60,000. Charles G. Hupfel is president.

New York, N. Y.—Considerable electrical equipment, including motors and other industrial electrical apparatus will be installed in the 1-story ice manufacturing plant to be constructed by the State Ice Mfg. Corp. on Stanton street, near Tompkins street, estimated to cost $500,000. The company was organized recently. Schwartz & Jakobson, 150 Nassau street, represent the company.

New York, N. Y.—Electric traveling cranes and other electrically operated conveying and loading machinery will be installed on the proposed piers to be constructed by the city at Flushing Bay, L. I. The project is estimated to cost $2,500,000. Murray Hulbert, Municipal building, Commissioner of Docks, in charge of the work.

New York, N. Y.—Kentucky & West Virginia Power Co., 30 Church street, is completing plans for a generating plant in the Big Sandy district near Pikesville, W. Va. Francis R. Weller, Hibbs building, Washington, D. C., is engineer.

Edgewater, N. J.—An electric power plant, with initial installation of about 1,000 kw., will be erected by the Archer Daniels Linseed Co., Minneapolis, at its plant to be constructed on site recently purchased at Edgewater. The entire plant will consist of a number of buildings, and is estimated to cost $150,000. Contract for the structures has been awarded to the Tilt-Hargan Co., 90 West Broadway, New York City.

Jersey City, N. J.—Hudson Boulevard Commission has awarded a contract to the Public Service Electric Co., for furnishing service for the street-lighting system on the boulevard, from Communipaw to Terhune avenue. Heretofore electric energy from the county power house at Laurel Hill has been used for the installation.

Erie, Pa.—Considerable electrical equipment will be installed at the plant of the Keystone Rubber Mfg. Co., East 11th street, in connection with rebuilding the factory recently destroyed by fire. It will be 3 stories and equipped for general rubber manufacture. Address Joseph B. Mooney, president.

Harrisburg, Pa.—The city council has awarded a contract to John H. Wickersham, Lancaster, Pa., for erection of a power house at the waterworks pumping station, and for the installation of two 15,000,000-gal. pumps and auxiliary equipment, at a cost of $243,622. The work will be placed under way at once.

Harrisburg, Pa.—Steam power equipment, ice and cold storage apparatus, electrical equipment, etc., will be installed in the addition to the service department at the Harrisburg hospital, in accordance with plans prepared by the Board of Trustees. With a new ward building and other structures the work is estimated to cost $900,000.

Lancaster, Pa.—Lancaster Milk Products, Inc., will construct a 1-story power house at its new plant at 623 32d street, estimated to cost $100,000. John Harman, 48 North Queen street, is architect.

Philadelphia, Pa.—Department of City Transit, City Hall, will commence immediate erection of two power houses on Cumberland and Griscom streets, estimated to cost $45,000 and $42,000, respectively.

Philadelphia, Pa.—Considerable electrical equipment, power equipment, mechanical draft apparatus, etc., will be installed in the addition to be erected to the public school at Thompson and 42d streets by the Board of Education, estimated to cost $250,000. Also, in the junior high school to be constructed by the board at 13th and Louden streets, to cost about $750,000. Plans are being prepared.

Philadelphia, Pa.—Electric motors and other industrial electrical equipment will be installed in the 1 and 2-story addition to be constructed at the leather manufacturing plant of the Wittman & Moriarity Co., Ontario avenue and C street, estimated to cost $100,000. Plans have been completed.

Philadelphia, Pa.—Considerable electrical equipment will be installed in the 4-story cold storage plant to be constructed at Milner and Delaware streets by the Farmers' Cold Storage Co., care of Engineers Ophus, Hill & McCreery, 112 West 42d street, New York City.

Philadelphia, Pa.—Electric motors and other industrial electrical equipment will be installed in the 3-story printing plant to be erected at 5th and Butler streets by L. J. Priestly, Jr., 1312 Sansom street, estimated to cost $80,000.

Philadelphia, Pa.—Considerable electrical machinery and equipment will be installed in the 10-story ice and cold storage plant to be constructed at Swanson and Water streets by the Producers' Cold Storage Terminal, Inc., estimated to cost $1,000,000. Andrew J. Sauer & Co., Denkla building, are engineers.

Philadelphia, Pa.—Electric motors, ovens, power house equipment and other electrical and mechanical apparatus will be installed at the addition to be established at the baking plant of J. S. Ivins' Sons, Inc., North Broad street. The company has acquired a tract of property adjoining its plant at 619-25 North Broad street, for ex-

pansion, to be utilized as the site and improved with a 5-story building, which will be remodeled and improved.

Pittsburgh, Pa.—The Aluminum Co. of America, Oliver building, has preliminary plans under way for construction of a hydroelectric generating plant in the vicinity of Long Sault Rapids, N. Y. F. S. Fickes is hydraulic engineer for the project.

Shamokin, Pa.—Pennsylvania Power & Light Co., Allentown, Pa., will keep a working force of about 200 men during the winter period for the construction of transmission lines from its generating plant at Hauto to Shamokin, Pa., and vicinity.

Sharon, Pa. — Pennsylvania - Ohio Power & Light Co. is completing construction of a transmission line from Sharon to Sharpsville, Pa., about 3½ mi., to operate under 3-phase, 22,000 volts. It is expected to have the system ready for service early in December.

Wilkinsburg, Pa.—An engine and power house will be established by the Wilkinsburg Ice Co., 208 Centre street, in connection with the erection of its ice plant at Turtle Creek, Pa. Plans have been drawn.

Baltimore, Md.—Columbia Graphophone Factories Corp. has perfected plans for installation of a coal conveyor plant and system at its works now in course of construction in the Orangeville section.

Port Deposit, Md.—Susquehanna Power Co., New York City, headed by Francis T. Homer, 40 Wall street, has preliminary plans under way for the construction of a series of hydroelectric generating plants along the Susquehanna river in Maryland and Pennsylvania, in accordance with charter rights granted by the two states. The entire project is estimated to cost $10,000,000, including transmission system. The first plant will be located in the vicinity of Port Deposit, and plans for the station are under way.

Norfolk, Va.—Electric motors and other electrical equipment, refrigerating apparatus, etc., will be installed in the addition to be constructed to the ice plant of the Anheuser-Busch Co., estimated to cost $200,000. Plans are being completed. Ophus, Hill & McCreery, 112 West 42d street, New York City, are engineers.

Roancke, Va.—Electric motors and considerable other electrical equipment will be installed at the plant of the Harris Hardwood Co., in connection with rebuilding the portion of the factory recently destroyed by fire. It is estimated to cost $100,000. George L. Wade is general manager.

Elkins, W. Va.—The Elkins Power Co. is planning the installation of additional equipment at its plant, increasing the present output by over 1,000 hp. The company has recently increased its capital from $50 000 to $100,000 for expansion. C. C. Bosworth is general manager and engineer.

Wheeling, W. Va.—Bids will be received on Dec. 12 for the purchase and installation of one electric pump, to be used in the Wheeling High School. Address Frank Stanton, clerk.

Charlotte, N. C.—Southern Power Co. has announced plans for two hydroelectric plants to cost $10,000,000; one with a capacity of 80,000 hp. and the other with a maximum capacity of 60,000 hp. Address the president.

Asheville, S. C.—Plans have been completed for erection of a plant by the Asheville Telephone & Telegraph Co. A switchboard and new equipment will be placed, the expenditure amounting to $40,000. Address M. A. Erskine, manager.

Williston, Fla. — An election will be held Dec. 28 to vote on the question of issuing $47,000 worth of water and light bonds. Address the mayor.

NORTH CENTRAL STATES.

Lorain, O.—Lorain County Electric Co. will expend $1,000,000 for improvements to its plant, which will include construction of additional boiler and engine houses, a new turbine with 20,000 kw. hrs. capacity and other machinery. Address the president.

Miamisburg, O. — The municipal electric light plant was recently destroyed by fire. Address the mayor.

Sidney, O.—Bids will be received on Dec. 27 for installation of an ornamental lighting system about the Shelby County courthouse square. Address W. A. Harman, clerk of the board.

Battle Creek, Mich.—The question of issuing municipal light bonds will be submitted to vote upon at the spring election. Address the mayor.

Grand Haven, Mich.—Story & Clark Piano Co. plans to erect a 1-story power house. Plans have been prepared by Byron E. Parks & Son, Grand Rapids, Mich.

Remus, Mich.—The village board is planning ways and means to secure electric lights. Address the village clerk.

Connersville, Ind.—Interstate Public Service Co., Newcastle, Ind., is completing negotiations with the Hydro-Electric Light & Power Co. of this place for the purchase of its local plant and property. Application for permission to acquire the utility has been made to the Public Service Commission. Upon acquisition the interstate company will connect the Connersville lines with its system.

Indianapolis, Ind.—Indiana Hydro-Electric Power Co., recently organized with a capital of $5,000,000, has plans under way for construction of the first five hydroelectric generating plants on the Tippecanoe river. It will be located at Norway, near Monticello, and is estimated to cost $1,000,000 with machinery. Subsequent plants, all to be tied up with a main transmission system, will be constructed at Oakdale, Springboro and Tioga, with final site to be selected. Samuel Insull, head of the Middle West Utilities Co., 72 West Adams street, Chicago, is president of the company, and Harry Reid, president of the Interstate Public Service Co., Indianapolis, is vice-president and general manager.

Indianapolis, Ind.—Electric motors and other industrial electrical equipment will be installed in the plant to be constructed on South Denny street by the Alena Steam Products Co., Hume-Mansur building, recently organized, to manufacture steam-operated motor trucks. The plant will cost $50,000. Address Frederick Hamilton, president.

Indianapolis, Ind.—Indiana Hydro-Electric Co., has been organized with $10,000 capital stock, by H. E. Reid, I. E. Guthrie, J. A. Shafer and Ernest Van Arsdel.

Alden, Ill.—Western Electric Co. of Walworth proposes to extend electric lights to Alden. Address Mr. McClellan.

Burlington, Ill.—An election will be held to vote on the question of issuing electric light and power bonds. Address the mayor.

Carmi, Ill.—Plans are being discussed for installation of a "white way" system on Main street. Another special meeting will be held soon. Address Will R. Archer, president of the Carmi Commercial Assn.

Springfield, Ill.—Illinois Power Co., 114½ East Washington street, has been incorporated with $1,000 capital stock to generate and deal in electricity, by P. B. Warren, A. D. Mackie and William B. Jess.

Beloit, Wis.—The council has established an ornamental lighting district. Address B. E. Wood, city clerk.

Duluth, Minn.—Plans are being prepared for completion of a "white way." Address P. G. Phillips, commissioner.

Minneapolis, Minn.—Board of Education plans to install a machine shop, electrical shop and general mechanical department in the 2 or 3-story junior high school, estimated to cost $600,000. A site will be selected at an early date. E. H. Enger, City Hall, is architect.

Willmar, Minn.—The city has purchased a site for a new electric light plant. Address H. Gunderson, city clerk.

Muscatine, Ia.—A campaign is being made for a municipally owned electric light plant. Willis J. Spalding of Springfield, Ill., manager of the combined light, water and power plant of that city, which is municipally owned, will be one of the speakers.

Oakville, Ia.—Plans are being prepared for construction of an electric light line from Oakville, Huron and Kingston, to be extended from Briggsville and Oquawka, Ill. by submarine cables. Address Henderson County Electric Light Co., Briggsville, Ill.

Lamar, Mo.—Osage River Power Co has preliminary plans under way for erection of a hydroelectric generating plant on the Osage river, estimated to cost $2,000,000, including machinery. Reed Wilson is consulting engineer; W. E. Brooks is manager.

St. Charles, Mo.—Engineers Banham and Mulligren, Kansas City, will give specifications and estimates of costs for a municipal light and water plant in St. Charles.

St. Louis, Mo.—Considerable electrical equipment will be installed in the car repair shops to be erected by the Missouri-Pacific Railroad Co.

with cost estimated at $200,000. The largest shop will be located on 21st street, St. Louis. The other shops will be constructed at Jefferson City, Crane, Nevada and Sedalia, Mo., each 1 story.

St. Louis, Mo.—A survey has been completed which shows that 122 miles of the city's streets are without lighting of any character. The estimated cost of installing lighting equipment is $900.000. Address Director of Public Utilities Hooke.

Brookings, S. D.—Bids will be received Dec. 15 for erection of a power plant building, one heating tunnel 902 ft. long, one reinforced concrete stack, one steel breeching, two industrial carts, one boiler pump, etc. Address V. F. Quist, clerk. Plans have been prepared by Kirby Theron Snyder, architect and engineer, 1221 Plymouth building, Minneapolis.

White River. S. D.—Plans are being prepared for construction of a hyroelectric plant on the White river and $5,000 will be expended in constructing a dam. Address F. W. Schwartz, owner of the plant.

Van Hook, N. D.—Plans are being prepared for improvements to the power plant by the Van Hook Electric Co. Address H. Gundersen, city clerk.

Zap, N. D.—The telephone system has been purchased by Otto W. Mueller, who plans to make improvements.

SOUTH CENTRAL STATES.

Birmingham, Ala.—Alabama Power Co. has disposed of a bond issue of $5,500,000, proceeds to be used for general operations, hydroelectric power plant and line extensions and improvements, etc. Address Thomas W. Martin, president.

Geneva, Ala.—S. L. Latimer is interested in the project of securing water power from the Choctawhatchee river to supply the neighboring towns with electric current.

Slocomb, Ala.—Service for lighting and power will be installed Feb. 1, 1922, by the Houston Power Co., Newton, Ala. A 24-electric service will be supplied. Address the manager.

Caddo, La.—An electric plant will be installed in the Charity hospital. Address chairman of board.

New Orleans, La.—New Orleans Railway & Light Co. is arranging an appropriation of $1,000,000, most of which will be used to purchase new electric generating and other power plant machinery. It is proposed to provide facilities to accommodate 2,500 new consumers. Address the manager.

Ardmore, Okla. — Improvements amounting to $103,000 will be made in this city by the Southwestern Bell Telephone Co. Address F. F. Clark, district manager.

Eldorado, Okla.—The city is considering the expenditure of $40.000 for an electric light plant. Address Mr. Berry, Commercial Club.

Hunter, Okla.—Work on construction of an electric high line and local system for distributing electricity over the town has begun. Address the mayor.

Oklahoma City, Okla.—Nov. 26 the city voted on a proposed $7,000,000 bond issue for water works, fire department, sewer, hospital and park improvements. Address the mayor.

Pawnee, Okla.—Light and water bonds amounting to $100,000 have been voted.

Corpus Christi, Tex.—Corpus Christi Railway & Light Co., suffered a fire loss on Nov. 19 estimated at $80,000 including machinery. The plant will be rebuilt.

Lubbock, Tex.—Texas Utilities Light & Ice Co. is planning to rebuild its power and ice-manufacturing plants which were recently destroyed by fire with a loss estimated at $100,-000, including equipment.

Plainview, Tex.—Texas Uutilties Co. has plans under way for extensions in its electric generating plant. An addition to the ice-manufacturing plant will also be constructed. Address J. B. Scott, manager.

Yorktown, Tex.—Large manufacturing firms of the city all use electric power and protest against the charge made by the local plant. The Yorktown Cotton Oil & Manufacturing Co. and other firms propose to build power plants. Address the manager.

WESTERN STATES.

Oroville, Wash.—Okanogan Valley Power Co. has preliminary plans under way for the second unit of its hydroelectric generating plant on the Simulkameen river, estimated to cost $75 000.

Seattle, Wash.—Northwestern Power & Mfg. Co., New York building, has filed a permit to construct a hydroelectric generating plant at Lake Crescent and Lyre river, Clellam county, estimated to cost $400,000, with machinery.

PROPOSALS.

Baton Rouge, La.—Sealed bids will be opened in the office of the mayor, Dec. 20, for lighting the city of Baton Rouge with electricity for periods of two, five and ten years, with not less than 250 to 500 incandescent street series lamps. Also for furnishing electricity for lighting municipal buildings and to operate motors for all city purposes. Specifications may be obtained at the office of the Commissioner of Finance, City Hall.

New York, N. Y.—International Mercantile Marine Co., 9 Broadway, acting for the Emergency Fleet Corp., Washington, D. C., will take bids until Dec. 29, for reconditioning the steamship Leviathan, now docked at Hoboken, N. J. The work will include installation of considerable power plant equipment, transforming the present coal burning system to one utilizing oil fuel. The project is estimated to cost $5,000,000, including machinery.

INCORPORATIONS.

Evansville, Ind. — Crescent City Electric Co. Capital, $150,000. To manufacture electrical machinery. Incorporators: R. P. Oblinger, H. E. Rasmusson, J. D. Meek and C. E. Roberts.

Seattle, Wash.—Northern Radio & Electric Co. Incorporated to manufacture wireless equipment, etc. Incorporators: R. W. Bell and H. S. Tenny. The company is represented by McClure & McClure, Hoge building.

Chicago, Ill.—Electric Draft Heater Corp., 914 South Michigan avenue. Capital, $6000. To manufacture heating devices, etc. Incorporators: R. E. Leopold, G. W. Axelson and E. A. Zimmerman.

Chicago, Ill.—Vertical Clock Products Co., 300 North Wabash avenue. Capital, $50,000. To manufacture and deal in timing devices, etc. Incorporators: Clyde A. Vonmauer, I. J. Thompson and H. W. Hoegstra.

Chicago, Ill.—Universal Specialty Co., 1462 Newbury avenue. Capital, $20,000. To manufacture and deal in telephone apparatus, etc. Incorporators: Wm. L. Asher, Alfred B. Lowin and Sam Marcus.

Boston, Mass.—Triad Electric Co. Capital, $25,000. To manufacture electrical equipment. Edward J. McCaffrey, president; Aubrey S. McLeod, Bedford, Mass., treasurer.

Ipswich, Mass.—The Merrill Co. Capital, $25,000. To manufacture electrical appliances. Arthur C. Doman, president, and John James Merrill, treasurer.

Ogdensburg, N. Y.—The Selso Co. Capital, $50,000. To manufacture electric water heaters and other electrical equipment. Incorporators: H. J. Parker, M. H. Stevenson and R. C. Sanford, Ogdensburg.

New York, N. Y.—Enco Electric Novelty Co. Capital, $24,000. To manufacture and deal in electrical specialties. Incorporators: M. H. Cohen, David M. Smiley and F. Lese, 277 Broadway.

Wilmington, Del.—Champion Electric Manufacturing Co. Capital, $4,-600,000. To manufacture electrical machinery. The company is represented by the Delaware Registration Trust Co., 900 Market street, Wilmington.

Greensburg, Ind.—Lee Bird Electric Service, Inc. Capital, $100,000. To operate an electrical contracting business. Incorporators: Lee Bird, Frank Hamilton and Carl Mendenhall.

FOREIGN TRADE.

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Appliances (350)—A mercantile firm in France desires to purchase all kinds of electrical appliances for household uses, particularly carpet sweepers and brushes for polishing hardwood floors. Quotations should be given c. i. f. French port. Correspondence should be in French. References

Electric Lamps (351)—A firm in Canada desires to purchase portable electric lamps. Quotations should be given f. o. b. port of shipment. Cash to be paid. References.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

Sell Additional Issue of Electric Bond & Share Co. Stock.

An additional issue of $1,250,000 Electric Bond & Share Co. 6% cumulative preferred stock offered last week at a price of $89 per share, to yield about 6.75%, by Bonbright & Co., Chicago, has been sold. The Electric Bond & Share Co., incorporated, Feb. 28, 1905, takes a financial interest in electric power and light and gas enterprises. It buys, holds and sells securities issued on such properties, and acts as fiscal agent and supervises the operation of companies controlling and operating such properties. All the outstanding common stock is owned by the General Electric Co.

For the year ended Oct. 31, 1921, net income, after federal taxes, was $2,274,803.63, or over 3.3 times annual dividend requirements of $675,000 on the total amount of preferred stock outstanding, including this issue. It is stated that the net income of the company since its incorporation in 1905 has been sufficient to meet the preferred dividend payments during all of that period more than 3.9 times.

Gold Bonds of Philadelphia Electric Co. Sold to Bankers.

The Philadelphia Electric Co. sold $12,500,000 first lien and refunding mortgage bonds to Drexel & Co., Brown Bros. & Co., and the Harris Trust & Savings Bank. The bonds are due Dec. 1, 1941, and are being offered at 99 and interest, yielding nearly 6.10%.

Adirondack Power & Light Corp.

	1921.	1920.
September gross	$ 398,496	$ 435,405
Net loss after tax	24,853	*46,090
Def. after charges	105,053	25,818
12 mo. gross	4,753,917	4,520,709
Net after taxes	1,337,906	1,260,768
Surplus after charges	420,364	611,559

*Gain.

Note—12½% of revenues is included in operating expenses to cover replacement, renewals, etc.

Northern Ohio Electric Corp. and Subsidiaries.

	1921.	1920.
September gross	$ 660,887	$ 911,603
Net after taxes	150,465	148,668
Surplus after fixed charges	8,460	14,254
Deficit after preferred dividends	21,539	15,745
12 mo. gross	9,067,245	10,975,598
Net after taxes	1,969,280	2,701,387
Surplus after fixed charges	198,699	1,109,897
Deficit after preferred dividends	161,301	*749,897

*Surplus.

Consumers Power Co. and Michigan Light Co.

	1921.	1920.
September gross	$1,114,844	$1,209.032
Net after taxes	450,346	241,105
Surplus after charges	249,235	65,068
Balance after preferred dividends	176,912	*393
12 mo. gross	14,225,953	13,605,687
Net after taxes	5,510,438	4,152,257
Surplus after charges	3,200,238	2,202,366
Balance after preferred dividends	2,373,367	1,427,902

*Deficit.

American Power & Light Co. Subsidiaries.

	1921.	1920.
September gross	$2,029,144	$1,897,863
Net earnings	841,373	544,692
12 mo. gross	24,788,057	19,924,461
Net earnings	8,713,340	7,054,472

Combined Earnings of Standard Gas & Electric Co. Operated Properties.

The combined earnings of Standard Gas & Electric Co.'s operated utilities for the 12 mo. ended Oct. 31, 1921, compared with the earnings of the corresponding previous year as follows:

12 mo. ended Oct. 31:

	1921.	1920.
Gross revenue	$34,765,485	$31,324,089
Gross earnings*	33,546,137	29,776,019
Net earnings	11,967,620	11,038,916

*Does not include revenue collected from other producing companies.

Individual earnings of operating utilities:

Louisville Gas & Electric Co.

12 mo. ended Oct. 31:

	1921.	1920.
Gross earnings	$ 4,868,847	$ 4,294,729
Net earnings	2,212,379	2,051,021

Mobile Electric Co.

12 mo. ended Oct. 31:

	1921.	1920.
Gross earnings	$ 749,681	$ 750,212
Net earnings	244,980	219,403

Northern States Power Co.

12 mo. ended Oct. 31:

	1921.	1920.
Gross earnings	$13,025,652	$11,277,738
Net earnings	5,010,262	4,346,011

Oklahoma Gas & Electric Co.

12 mo. ended Oct. 31:

	1921.	1920.
Gross earnings	$ 3,824,239	$ 3,435,621
Net earnings	1,285,823	1,245,848

San Diego Consolidated Gas & Electric Co.

12 mo. ended Oct. 31:

	1921.	1920.
Gross earnings	$ 3,666,110	$ 2,543,004
Net earnings	1,059,375	859,044

Western States Gas & Electric Co.

12 mo. ended Oct. 31:

	1921.	1920.
Gross earnings	$ 2,494,601	$ 2,182,722
Net earnings	851,866	831,833

*Decrease.

Utah Securities Corp. Subsidiaries.

	1921.	1920.
September gross	$ 697,476	$ 696,550
Net earnings	326,891	313,432
12 mo. gross	8,767,908	8,163,433
Net earnings	4,160,581	3,889,944

Commonwealth Power Railway & Light Co.

	1921.	1920.
September gross	$2,511,572	$2,653,561
Net after taxes	779,774	579,455
Surplus after fixed charges	150,660	*6,678
Balance after dividends on preferred stock	60,895	*96,443
12 mos. gross	31,558,895	30,157,334
Net after taxes	10,017,850	8,848,246
Surplus after fixed charges	2,592,432	2,010,689
Balance after preferred dividends	1,515,252	933,509

*Deficit.

Virginia Railway & Power Co.

	1921.	1920.
September gross	$ 837,153	$ 867,210
Net after taxes	242,040	212,944
Total income	253,243	224,946
Surplus after charges	61,521	37,592
9 mo. gross	7,609,054	7,229,211
Net after taxes	2,264,014	2,155,711
Total income	2,365,992	2,267,608
Surplus after charges	649,469	580,296

Texas Power & Light Co.

	1921.	1920.
September gross	$ 442,214	$ 460,053
Net after taxes	176,903	80,813
Total income	180,796	81,057
Surplus after charges	116,979	22,272
12 mo. gross	5,166,212	4,331,004
Net after taxes	1,654,381	1,276,518
Total income	1,676,055	1,281,209
Surplus after charges	936,451	606,642
Balance after preferred dividends	656,451	350,267

Dividends.

	Term.	Rate.	Payable.
Ark. Val. Ry., L. & P., pfd.	Q.	1.75%	Dec. 15
Can. Gen. El., com.	Q.	2%	Jan. 2
Colorado Pr., pfd.	Q.	1.75%	Dec. 15
Cons. Gas, Balt., com.	Q.	2%	Jan. 3
Cons. Gas, Balt., pfd.	Q.	2%	Jan. 3
Ill. Bel. Tel.	Q.	$2	Dec. 31
Uni. Lt. & Rys., 1st pfd.	Q.	1.50%	Jan. 2

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid Nov. 28.	Bid Dec. 5.
Adirondack Electric Power of Glens Falls, common	6	12	12
Adirondack Electric Power of Glens Falls, preferred	6	81	81
American Gas & Electric of New York, common	..	115	124
American Gas & Electric of New York, preferred	6	41	42
American Light & Traction of New York, common	..	95½	106
American Light & Traction of New York, preferred	6	80	81
American Power & Light of New York, common	4	68	69
American Power & Light of New York, preferred	6	75	78
American Public Utilities of Grand Rapids, common	..	6	6
American Public Utilities of Grand Rapids, preferred	..	15	15
American Telephone & Telegraph of New York	9	117	116
American Water Works & Elec. of New York, common	..	6	6
American Water Works & Elec. of New York, particip	7	16	16
American Water Works & Elec. of New York, 1st preferred	..	58	59
Appalachian Power, common	..	6	6
Appalachian Power, preferred	7	49	48
Cities Service of New York, common	+extra	207	220
Cities Service of New York, preferred	6	59	59
Commonwealth Edison of Chicago	8	115	115
Comm. Power, Railway & Light of Jackson, common	..	8	14
Comm. Power, Railway & Light of Jackson, preferred	6	26	34
Federal Light & Traction of New York, common	..	8	9
Federal Light & Traction of New York, preferred	..	64	62
Northern States Power of Chicago, common	..	64	66
Northern States Power of Chicago, preferred	ex.div.7	81	81½
Pacific Gas & Electric of San Francisco, common	..	63	64½
Public Service of Northern Illinois, Chicago, common	7	80	80
Public Service of Northern Illinois, Chicago, preferred	6	81	81
Standard Gas & Electric of Chicago, common	..	13	14
Standard Gas & Electric of Chicago, preferred	8	31	39
Tennessee Railway, Light & Power of Chattanooga, common	..	1	1
Tennessee Railway, Light & Power of Chattanooga, preferred	6	5	5
Western Power of San Francisco, common	..	29	29
Western Union Telegraph of New York	..	91	92
Industrial—			
General Electric of Schenectady	8	134	143
Westinghouse Electric & Mfg. of Pittsburgh, common	7	47½	50